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A TUNGSTEN LAMP FOR A STREET ARC.

Series tungsten lamps rated at 250 watts each are now on the market, and central stations can save money by substituting them for many of the street arc lamps now in use. For the old direct-current arc of 1,200 nominal candlepower and 300 to 330 watts, and for the common, enclosed alternating-current arc of 400 watts, the 250-watt tungsten may be substituted, lamp for lamp, with good effect. If the open arc of 2,000 nominal candlepower, or the 7.5-ampere alternating enclosed arc is to be replaced, equal illumination may be obtained by the substitution of a somewhat greater number of the 250-watt tungsten lamps.

Compared with the 400-watt alternating arc, the 250-watt tungsten is fully equal in the matter of mean hemispherical candlepower, but lacks perhaps twenty per cent of intensity in directions thirty to forty degrees below the horizontal.

If the substitution is made lamp for lamp, the power required of the central station is reduced from 330 to 250 watts where the open arc of 1,200 nominal candlepower is displaced, and from 400 to 250 watts where the alternating arc is abandoned. This latter reduction of power amounts to thirty-seven per cent for series transformers, generators and engines. More than this, the higher power-factor with the tungsten lamps makes a further gain in the capacity of apparatus. Assuming that the constant-current transformers are about nine-tenths loaded in each instance, the power-factor should be about seventy per cent with the arcs, and about ninety per cent with the tungsten lamps. With these power-factors, the demand on the generators is 571 volt-amperes per 400-watt arc lamp, and 277 volt-amperes per 250-watt tungsten lamp, neglecting line and transformer losses. In other words, each tungsten lamp requires forty-eight per cent of the generator capacity necessary for a 400-watt alternating-current arc.

At the station no change is necessary in the equipment when 250-watt tungsten lamps are put up in place of the street arcs, except that a part of the capacity in arc dynamos, rectifiers or constant-current transformers will be no longer required. The 250-watt tungsten lamps are made to operate with 6.6 amperes, like the 400-watt alternating arc and the old open arc of 1,200 nominal candlepower, so that the required ampere capacity of apparatus and lines remains the same. With 6.6 amperes the 250-watt tungsten lamp requires thirty-eight volts at its terminals, so that the number of these lamps may be twenty per cent greater than the number of open arcs on a direct-cur-

rent dynamo, and fully double the number of 400-watt arcs on a transformer, because of the lower power-factor of the arcs.

The list price of the 250-watt tungsten lamp is $3.50 less discounts of ten and ten per cent in standard packages of one dozen each, giving a net price of $2.84 per lamp. As the manufacturers put the life of the tungsten lamps at 1,200 to 1,500 hours of use, it is conservative to estimate the cost of renewals on the basis of 1,000 hours life, which requires four lamps for a lighting year of 4,000 hours. On this basis the annual cost of renewals per 250-watt tungsten lamp is $11.36.

Against this cost of tungsten renewals should be set the annual expense of trimming and repairs on arc lamps, and a part of the expense of their inspection. Such costs must, of course, vary with wages, the location of lamps, and other local conditions, but the items of labor and supplies for trimming and repairs during 4,000 hours of lighting annually will be covered in many instances by $17.00 for each open arc of 1,200 nominal candlepower, and $7.00 for each 400-watt alternating arc. Where these figures apply, it appears that the renewal costs of the 250-watt tungsten lamp will exceed the trimming and repairs on the 400-watt alternating-current arc by about $4.36 per year, and will be less than the trimming and repairs on an open arc of 1,200 nominal candlepower by $10 yearly.

DECISION OF THE WORCESTER APPEAL.

In its decision, just announced, on the Worcester appeal the Gas and Electric Light Commissioners of Massachusetts affirm their previous conclusions in the case of the Fitchburg appeal. This Worcester appeal is the second to come before the commissioners from franchise grants to the Connecticut River Transmission Company for the sale of electric power in Massachusetts cities and towns.

As has previously been narrated, the Connecticut River company is engaged in the transmission and sale of electric power generated by the Connecticut River at a dam and hydroelectric plant in Vernon, Vt., several miles north of the Massachusetts line. The Connecticut River company is organized under the general laws of Massachusetts, and, as appeared at the Fitchburg and Worcester hearings, prefers to supply power only to large consumers, that is, in units of not less than several hundred horsepower.

In their grant of a franchise to the Connecticut River company, however, the Worcester aldermen provided that this company might supply any consumer whose motors and other apparatus connected for use had a rated capacity of not less than fifteen horsepower, and whose annual consumption should be not less than 22,500 horsepower-hours. As a fifteen-horsepower motor working at one-half load would deliver 22,500 horsepower-hours of mechanical work during 3,000 hours, the motor under these conditions would absorb 22,500 electric horsepower hours during a somewhat shorter period.

This provision of the franchise just stated was the one to which the Worcester Electric Light Company particularly objected in its appeal to the commissioners, the contention being that the Connecticut River company ought to supply no consumer with less than several hundred horsepower. It appeared at the hearing that the Worcester company had a connected load of about 2,000 rated horsepower in motors, and that the annual income from this source was about $54,000. It was also shown that the Worcester company has an extensive system of underground conduits in the city, and that the desire of the Connecticut River company was to make use of these conduits for the distribution of its power.

Since 1904, the motor load of the Worcester company had increased about eighty per cent, but its power income had increased only about forty-five per cent, because of reductions in rates. After the appeal was taken the Worcester company further reduced its power rates by about twenty-five per cent to the smaller consumers.

On these facts the commissioners concluded that the Worcester situation presented no sufficient reason to depart from the rule adopted in the Fitchburg decision, that the Connecticut River company may supply any consumer whose motors and other apparatus connected for use have an aggregate rated capacity of not less than 300 electric horsepower, and whose annual consumption shall not be less than 450,000 horsepower-hours. It may be noted that the operation of motors that consume 150 horsepower during 3,000 hours per year will give the required consumption of 450,000 horsepower hours.

In the course of its opinion the Board of Commissioners points out that if the Connecticut River company were to serve all classes of consumers its investment in a distributing system would increase the rates that it must charge for power, but if this company is to supply large consumers it cannot expect to receive much more than the cost to them of generating power. For the benefit of its consumers, the Worcester company should purchase such power as it requires that the Connecticut River company will sell at less than the cost of production to the Worcester company.

The grant of the Worcester aldermen limited the franchise of the Connecticut River company to twenty-eight years, but the commissioners remove the limitation, and say on this point:

"The provision in the order of the aldermen, limiting the exercise of privileges granted to a fixed term of only twenty-eight years, suggests, we believe, an entirely new departure in the treatment of similar companies in this state. Other states and municipalities have had experience in the granting of franchises for a definite limited term. Without attempting to fully discuss the important questions involved, we believe it is safe to say that such arrangements neither encourage the highest development of the properties involved, nor the lowest charges for service, and that they often discourage extensions and improvements, especially in the latter portion of the term. Where the privileges granted the company are not limited as to time, its relations to the public may, in the opinion of the board, be more effectively regulated and determined as the pubilc interest may seem to demand by-laws and other requirements equally applicable to all companies of that class."

The decision of the commissioners further provides that no purchaser of power from the Connecticut River company, except the Worcester Electric Light Company, shall, directly or indirectly, resell the same or any part thereof. Electric railways and railroads as well as the Worcester Electric Light Company are not limited in their purchases from the Connecticut River company by the provision as to 300 horsepower of motors and apparatus and a consumption of 450,000 horsepower-hours per year. These provisions, and also as to the resale of power purchased of the Connecticut River company, may be altered from time to time, on the written request of this company to the commissioners, or on the written complaint of at least twenty users of power in Worcester.

GYROSCOPIC BALANCING AND THE BRENNAN MONORAILWAY.

What may prove eventually to have been an epoch-making event was the recent demonstration in England of a full-sized, gyroscopically balanced, monorail car invented by Louis Brennan, and referred to in another part of this issue.

The gyroscope, the correct application of which is the feature of Brennan's invention, has up to comparatively recent times been regarded merely as an ingenious toy. Many people are acquainted with a few of its mystifying properties. With a form of the device which can be purchased at toy counters for a small price, many of these properties can be demonstrated. When the flywheel is caused to rotate at high speed, as by means of a string, it is difficult to hold the instrument in the hand, for a gyroscope of even a few ounces in weight will exert a surprising pull in resisting a force opposing its apparent inclinations. It will support itself, when the wheel is rotating at high speed, suspended in space at right angles to a string in apparent contradiction of all the laws of gravitation. If placed in a box while still spinning, the box will stand up on an edge or on one of its corners, nor will it fall down until the speed of the flywheel has become reduced beyond a certain (mathematically determinable) point!

The action of the gyroscope may be explained perfectly by the laws of rotating bodies, although the mathematics of the demonstration are not too elementary. The principle involved is, that if a mass is set in rotation about a principal axis of inertia of greatest or least momentum of the body, it will continue to revolve about this axis, and the direction of the axis will remain unchanged unless extraneous force is applied. The most wonderful property of the gyroscope is that when an effort is made to change the direction of the axis of rotation of the flywheel, the axis very forcibly resists such action and moves off in a direction at *right angles* to the direction of the applied force.

In Dr. Otto Schlick's invention for preventing the rolling of ships at sea, and which was very successfully demonstrated on the old German torpedo boat *Sea-bar,* the flywheel employed was one metre in diameter and weighed over 1,100 pounds. This was mounted amidships on a vertical axis. When it was caused to rotate at a velocity of about 1,600 revolutions a minute, by means of a specially designed turbine, and the secondary bearings of the gyroscope were released, the rolling of the ship was reduced from an oscillation of thirty degrees of arc to one of about one degree. The test was carried out in very rough weather, and the action of the Schlick gyroscope caused the ship's deck to remain almost exactly level, while the vessel as a whole heaved up and down with the waves. The *Sea-bar,* it may be noted, is 116 feet in length and has a displacement of about fifty-six long tons.

There is thus no doubt that the gyroscope as a balancing agent has been proved to be practical and powerful. The chance of its failure is infinitesimal, for a heavy gyroscope operating at high speed in a vacuum will run several days, and is effective as a balancer for many hours at least, before stopping, should the driving power be cut off from some cause or another. In the Brennan invention, the train, whether moving or stationary, is poised quite safely on the monorail as long as the gyroscopes are working safely. The speed of the latter, 3,000 revolutions a minute, or fifty revolutions a second, may be considered by some as extremely high, but this is not as great as the speed of many forms of turbines which have been safely operated for years. The mechanical difficulties have evidently been solved, as the reports of the recent trial in England of a car of commercial size do not tell of any hitch happening, and although troubles might develop in an extended trial under working conditions there would seem at this time to be no problem involved which could not eventually be successfully solved.

As with all inventions involving radically new ideas and upsetting all former traditions in their respective lines, it is difficult to predict the effect Mr. Brennan's invention will have on the traffic problem. Monorailways so far projected have met with little public favor. Apart from the toy line at Port Rush, in Ireland, the British monorail schemes so far promoted, namely, a high-speed line between Liverpool and Manchester, and another between London and Brighton, seem to have been abandoned for the time being, for nothing has been heard of them in reports from the other side for some time. If public confidence can be established in the gyroscopic monorailway and sufficient funds can be found to establish the venture commercially, it can safely be prophesied that passengers will be found to patronize the new idea, and this being done it only remains for the managers of the new undertaking to avoid accidents involving the destruction of human life to make the innovation permanent. It seems doubtful, however, that the gyroscopically balanced monorail system of Brennan will eventually supplant nearly all existing means of transportation, as has been claimed in some quarters, and it is probable that the new system, if commercially successful, will be restricted to a few high-speed lines, at least for many years to come. It will be interesting to note the operating cost of the gyroscope car, if and when the new invention can be commercially exploited.

Boston Electrical Show.

The first Electrical Show to be held in Boston, and, in fact, New England, was opened auspiciously on the evening of November 15. For about six evenings preceding the opening night the show was excellently advertised throughout the city by means of three gorgeous electrically illuminated floats which were operated over the elevated and surface lines throughout Boston.

On approaching the Mechanics' Building, where the show is held, for some distance on Huntington Avenue on either side of the exhibition hall, the street was brilliantly illuminated by flaming arc lamps furnished by the Edison Electric Illuminating Company of Boston. The effect was so startling that the avenue has been called the "Great Yellow Way." From Copley Square to Massachusetts Avenue it is a blaze of light.

On entering the exhibition hall one was impressed with the magnificence of the ensemble. The entire scheme of decoration portrays an Italian garden which covers practically the entire main floor with sculptured columns of exquisite modeling and sunken electric water gardens on the surfaces of which there are lilies and other aqueous plants illuminated by small electric bulbs. There is a profusion of low balustrades which are a good imitation of Carrara marble, exquisite pergolas interwoven with carvings and clusters of grapes lighted in an apparently mysterious way from within, and interspersed among these are the typical plants of Italy.

There are thousands of lights in the ceiling of the structure. The balcony was treated in harmony with the general scheme, and along the front of it are bright colored awnings divided by elaborately trimmed cedars and directly below these are beautifully carved gargoyles holding festoons of incandescent lamps. There is an abundance of light on all sides, chiefly from tungsten lamps. Along the main floor there is a series of eight columns of honor which form a very striking feature. Each is surmounted by five large globes. About 100 small fluted columns mark the various passages and separate the exhibit booths from each other.

The largest, and by far the most elaborate exhibit, is that made by the Edison Electric Illuminating Company of Boston. This exhibit occupies the stage of the exhibition hall and is replete with artistic features. A striking one of these is an Italian perspective about forty feet high and 100 feet long. Thirty young ladies in Italian costume are in attendance at this exhibit. Among other prominent exhibitors on the main floor are the Westinghouse Electric and Manufacturing Company, the General Electric Company, Allis-Chalmers Company and the National Electric Lamp Association.

There is the usual display of electrical vacuum cleaning and washing machines on exhibition. In the basement of the building there is a comprehensive exhibit of electric vehicles, electrically operated printing presses and other industrial electrical applications, besides the exhibit of the Boston Elevated Railway Company.

There are quite a number of electrical novelties in addition to those commonly seen at similar exhibitions, such as electric incubators and cow-milking equipments. Among these new features is a submarine electric launch and Ovington's 1,000,000-volt oscilator and high-frequency machines.

A series of lectures has been arranged for in the lecture hall. The topics are of a popular character and comprise among others the following subjects: "Electricity in the Home," "Past, Present and Future of Electricity," "Store, Window and Sign Lighting," "Electric Power," "Possibilities of Electricity," "Commercial Electrical Vehicles." Besides these and other interesting talks, there is being given a series of demonstrations of wireless telegraphy and telephony, as well as a number of experiments with high-frequency apparatus.

All the prospects of the first few days of the show pointed to its marked success in every detail. The exhibits are made by the most representative companies and are displayed in an attractive manner. The attendance has been very good, and there is plenty to interest for all classes of the public. The Empire Woman's Orchestra discourses an interesting programme both afternoons and evenings, and from all points of view the indications are that this is the first of a very successful series of Boston Electrical Shows. The show closes on the evening of November 25.

The list of exhibitors is as follows:

DEPARTMENT A (Main Floor.)

Allis-Chalmers Company.
American Flaming Arc Lamp Company.
Anderson, Albert & J. M.
Bay State Electric Company.
Blake Signal and Manufacturing Company.
Burlingame Telegraphing Typewriter Company.
Condit Electrical Manufacturing Company.
Condit, S. B., Jr., & Company.
Campbell Electric Company.
Clapp-Eastham Company.
Day, The J. H., Company.
Diehl Manufacturing Company.
Duntley Manufacturing Company.
Duren & Kendall.
Dow Surgical Battery Company.
Edison Electric Illuminating Company.
Edison Manufacturing Company.
Electrical Review and Western Electrician.
Electric Cleaner Company.
Electric Storage Battery Company.
Electrical Contractors Association of Boston.
General Electric Company.
Gage Publishing Company.
Gest, G. M.
Holtzer-Cabot Electric Company.
Hurley Machine Company.
International Correspondence School.
Invincible Electrical Sales Renovating Company.
Ley, Fred T., & Company.
"1900" Washer Company.
National Acme Manufacturing Company.
National Electric Lamp Association.
New York Electrical School.
New York Pole Company.
Quimby, The W. S., Company.
Radio Reflector Company.
Singer Sewing Machine Company.
Simplex Electrical Heating Company.
Stuart-Howland Company.
Shelton Electric Company.
Snow, Franklin A.
Snow Iron Works, W. A.
Westinghouse Electric and Manufacturing Company.
Whiting, D., & Company.
Westchester Appliance Company.

DEPARTMENT B (Basement).

Adams, J. Q., & Company.
American Technical Society.
Baker, R. G.
Bailey, S. R., & Company, Inc.
Boston Electric Garage Company.
Boston Elevated Railroad Company.
Baker Electric Company.
Boston Lightning Rod Company.
Cross Paper Feeder Company.
Dodge Motor Vehicle Company.
Dearborn Drug and Chemical Company.
Electrical Testing Laboratories.
Electric Vehicle Company.
Knowles, C. S.
MacAlman, J. H.
Massachusetts Fan Company.
Mergenthaler Linotype Company.
Murdock, W. J., Company.
Neale, A. F.
Nugget Polish Company.
Rae Electric Vehicle Company.
Studebaker Brothers Company.
The Waverly Company.
Ziegler, P. R., & Company.

National District Heating Association.

The first annual convention of the National District Heating Association was held at Columbus, Ohio, on November 10 and 11. The convention was well attended, considering the youth of the association, which was formed at Toledo last July. The organization was perfected, and a short but good programme of papers was presented. Much interest was taken in the discussions. It was decided to hold the next convention at Toledo, Ohio, some time next May, the exact days to be decided by the executive committee. The prospects before the association are excellent, and the good it will do to central stations in pointing out another source of income and other means of getting new customers are already evident.

Dr. Steinmetz Lectures in Chicago.

The second of the present series of joint meetings of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers was held on the evening of November 16 in Fullerton Hall of the Art Institute of Chicago. The speaker of the evening was Dr. Charles P. Steinmetz, who lectured on "The Conservation of Energy." The hall was thronged when Chairman W. L. Abbott of the Chicago Section opened the meeting by stating that the occasion was a memorable one since there were present three past presidents of the Institute, two past prsidents of the Western Society of Engineers and Secretary Ralph W. Pope, of the Institute. He introduced Bion J. Arnold, who acted as chairman of the meeting. Secretary Pope was called on for some remarks, and stated that the Institute is now well toward the lead of the engineering societies of the country. Continual efforts are being made to extend the influence of the Institute still further so that it may be represented in every section of the country. He referred briefly to his recent western tour and stated that he is now starting on another but shorter trip to the sections located in the cities of the Central West.

Doctor Steinmetz opened his lecture by calling attention to the fact that all matter is subject to the two laws of conservation of matter and the conservation of energy. The first of these laws is the older one, having been formulated some 200 years ago with the beginning of modern chemistry. The law of conservation of energy is about a century old. Both these laws are the foundation of modern science. The first one is very generally known. The law of the conservation of energy, however, is not so well known, for we still occasionally hear of attempts at perpetual motion. In brief, this law says that energy, like matter, cannot be created nor destroyed, it can only be changed in form. A corrollary of this law is that in every energy transformation some energy is apparently lost but really dissipated as low temperature heat. This is similar to our waste of matter and is known as the second law of thermodynamics. This degradation of energy requires a continual supply of additional energy.

Human beings are energy transformation machines. All the energy we obtain as food ultimately comes from the chemical energy of plants. These received their energy as radiant energy from the sun. Sunlight is the real source of all energy used to sustain animal life. This, however, is insufficient for our industrial needs. We must also use the energy of fuel, water power, etc. Coal is the chief source of this additional energy supply; it represents the chemical energy obtained from the sun in the carboniferous age. Water power represents energy obtained more directly from the sun. All sources of energy that we utilize revert ultimately back to the sun, except the tides, whose power is obtained from the rotational energy of the earth and the gravitational force of the moon; this is not very great, however, as a source of industrial energy.

Practically all our efficiency calculations are based on the law of the conservation of energy. For instance, we determine the electrical output of a generator and add the calculated losses to this to find the mechanical input. The calculation of problems dealing with only one form of energy is comparatively simple and accurate, but our calculations become more complex when different forms of energy are concerned. Here it is extremely valuable to make use of the law of the conservation of energy. This point was illustrated by considering the problem of calculating the force exerted between a horseshoe magnet and its armature. This is greatly simplified by equating the force times an assumed distance the armature has moved with the electrical work done by such an assumed movement. This method was also applied by the speaker to the problem of finding the force exerted between the primary and secondary coils of a transformer when the latter coil is short-circuited.

Even when treating a problem involving only one form of energy, it is often advantageous to make use of the law of the conservation of energy to bridge over some intricate portion of the problem. This was illustrated by considering what happens when a circuit is opened that contains inductance or capacity by showing the relation of the electromagnetic and electrostatic energy. The speaker emphasized the great value of the law of the conservation of energy as the convenient means of establishing relations between different forms of energy.

At the conclusion of the lecture the old question of what becomes of the mechanical energy of a tightly coiled spring that is placed in dilute sulphuric acid to dissolve was propounded to Doctor Steinmetz. The lecturer had a ready reply to this. He stated that the chemical action will be slightly more rapid than it would have been if the spring had not been under tension. Probably greater heat would also be developed during the solution. It would be difficult to determine this exactly, however, because the slightly increased heat evolved would be difficult to measure in comparison with the enormous heat set up by the solution. Doctor Steinmetz referred to the known fact that parts of an iron object under stress corroded more rapidly then those which are not subjected to stress as further illustrations of his conclusions.

Coercion Decision in Germany.

Deputy Consul-General Simon W. Hanauer writes from Frankfort that trusts and commercial combines in Germany have recently been the objects of an important legal decision, one of which he cites:

The director of one of the works of a syndicate addressed several letters to a firm purchasing goods from the syndicate works, threatening the firm that it would receive no more goods from the combine if the firm continued to purchase any goods from any concern not belonging to the syndicate. As the customer firm was dependent upon the combine for certain lines of manufactures it complied with the demand. Suit was then brought in the court at Schweinfurth against the director for having by his letters committed an act of coercion. The court acquitted the defendant, but the state's attorney brought the case on appeal before the Supreme Court of the Empire, which set aside the judgment rendered below, and remanded the case for retrial to the Criminal Court at Nuremburg, by which tribunal the director was found guilty of an attempt at coercion and sentenced to undergo thirty days' imprisonment.

Toledo Electrical Show.

The members of the Toledo Electrical Dealers' Association have planned a big electrical show and exposition to be held at the Toledo Coliseum during the week commencing January 31, 1910. This is designed to be the first of a series of annual shows which it is hoped to make a permanent winter feature for the city. An exhibit of electrical devices for cooking, heating, ironing and washing machines will be an attractive feature of the exposition. A series of lectures on electrical subjects and a program of amusements are also contemplated in connection with the show. H.

Annual Meeting of the Electrical Trades Association of Chicago.

The fourteenth annual meeting of the Electrical Trades Association of Chicago was held at the University Club Friday evening, November 12. In every respect the meeting was an unquestionable success. The banquet room was tastefully decorated, a sumptuous repast was served, and the singing of old familiar songs, which was intermingled with the courses of the dinner, did much toward creating the spirit of goodfellowship which prevailed among the large assembly.

Following the dinner the report of the secretary and treasurer was read and adopted. Probably the most important feature of the necessarily brief business session was a motion made by James Wolff regarding changing the name of the association. The National Association is considering changing its name so as to substitute the word "Credit" for "Trades," and the motion made by Mr. Wolff was that the Chicago branch commend any action regarding this change taken by the National organization.

Toastmaster Charles E. Brown assumed charge of the meeting immediately following the completion of the business session and introduced the first speaker, Samuel Insull, president of the Commonwealth Edison Company, who delivered an entertaining and highly interesting address on "Thirty Years of Electrical Development."

Mr. Insull first explained how he became interested in electricity. While a young man and living in London he was attracted one morning by an American magazine, and in this publication read a story about Thomas A. Edison and his inventions. A few months later Mr. Insull was employed as the private secretary of Mr. Edison's European agent. Later he came to America and then actually saw an exhibition of the direct-driven unit, about which he had read in the magazine already mentioned. This unit consisted of a dynamo of Edison make and a Porter-Allen engine and was installed at Melrose Park.

Following this introduction Mr. Insull in chronological order mentioned various electrical developments and the rapid advancement of the industry up to the present time. The Central West can claim the first central station, as Appleton, Wis., was the first town to have such a distribution system. Shortly after this, however, a central station was put in operation in New York city. The first miniature railway was placed on exhibition in Berlin, Germany, in 1879. Two years later an electric road was put in operation. The electrical congress which met at the exposition held in 1881 made standard the electrical units now in common use, namely, the volt, ohm and ampere. It was also at this exposition that the first public demonstration was made of the direct-driven unit. In the years between 1882 and 1886 alternating current and the three-wire system came into general use and did much toward advancing electricity to the place it now holds. In 1886 Elihu Thomson made electric welding commercially practicable. Two years later Sprague's electric railroad was put in operation at Richmond, Va., and was successfully operated. This, Mr. Insull claimed, was the first commercial electric traction system. In this same year the first central station was established in the city of Chicago, although there were a number of isolated plants throughout the city at that time. The polyphase current patents, which formed a basis of the now well-known alternating-current machines, were also taken out during this year. The Paris Exposition, held in 1889, marked a milestone in the electrical industry. It was at this exposition that the now much-used watt and kilowatt were defined by the electrical congress held at that time. In the following year electric power transmission was successfully accomplished. The Chicago World's Fair, held in 1893, marked another milestone in electrical development. This fair was decidedly an electrical one, and many electrical developments which are now important features in the industry owe their origin to this fair. The year 1895 is noted electrically for the invention of the X-ray machine and Marconi's invention of wireless telegraphy in Italy. The developments during the succeeding years up to 1909 were briefly outlined, and in conclusion, Mr. Insull presented figures which are overwhelming in view of the fact that only thirty years have elapsed since electricity was first used commercially to any appreciable extent. In the city of Chicago alone the electrical industry represents a capital of $500,000,000. Other figures presented by the speaker showed that there are at present 5,000,500 telephones in use; 40,004,072 miles of electric traction representing an investment of approximately $4,000,000,000, 6,000 central stations in the United States, of which number over 3,000 are engaged in the electrical supply business. These central stations develop approximately 2,000,000 horsepower and have a gross yearly income of $250,000,000.

Following the address of Mr. Insull, James Wolff, the national representative of the Chicago branch, delivered a brief address, reviewing business transacted at the National Association's meetings.

Judge Frederick L. Fake delivered a brief but interesting address entitled, "Observed from the Bench." Judge Fake compared the different courts throughout the United States, showing the different classes of cases, attorneys and people who appeared before the various courts, also the difference in time between deciding cases in the lower courts with the time allowed in the higher ones.

H. E. Hackenburg, of the National Carbon Company, Cleveland, Ohio, read a paper entitled, "Our Association." After reviewing the association's history and outlining a number of benefits to be derived from being a member, Mr. Hackenburg confined his paper to examples of the benefits the company he represented derived from its membership. He outlined briefly the credit system being used by his company and explained the methods used when prospective customers applied for credit, thus showing the value of the membership in the Electrical Trades Association.

Toastmaster Brown next introduced C. E. Kremer, who amused the assembly by his recitation of amusing poems and comic stories.

For the ensuing year the following officers were elected or re-elected:

Frank M. Pierce, of the Manhattan Electric Supply Company, president.

Frank Horton, of the Moran & Hastings Manufacturing Company, vice-president.

James Wolff, New York Insulated Wire Company, national representative.

Frederic P. Vose, secretary-treasurer.

The executive committee is composed of the following members: A. B. Conover, John A. Roebling's Sons Company; E. Kennedy, Central Electric Company; Wm. A. Browne, M. B. Austin & Co.; Frank Horton, Moran & Hastings Manufacturing Company; Thos. I. Stacey, Electric Appliance Company, and A. O. Kuehmsted, Gregory Electric Company.

Electric Cooking—An Englishwoman's Experience.

Some time ago an abstract was given in these columns of an article by a correspondent of *The Electrical Review*, of London, Eng., signing herself "Maud," which was interesting as showing the views of the one ultimately most concerned, of the housewife, in other words, on elec-

trical appliances for the household. The following item is a further contribution from the same litterateur, which appeared in a recent issue of our London contemporary:

After a somewhat chequered and interesting experience with regard to electric lighting and the simpler forms of electric heating and cooking, I decided to try an electric oven. The majority of housewives shrink from this mode of cooking chiefly on account of cost, but the information which I have at hand, based on my own experience, contradicts this commonly asserted notion, that electricity is very dear for cooking purposes.

Let us take first the simplest and most commonplace method of cooking—that of a coal fire—and suppose we have to deal with an average-sized cooking range; this, I find, costs, on an average, to cook a dinner consisting of a joint (about five pounds), pudding, pastry and vegetables, about five cents in coal, allowing for coal at $4.00 per ton; you may say that for this price you also have a constant supply of hot water, but this is not always the case, as usually the boiler damper must be closed to allow sufficient draft to heat up the oven, and therefore the cost of heating water for the house is an entirely separate charge.

Passing on to gas cooking, it is found that this costs for the same dinner six cents; this price does not include the time and gas taken to heat up the oven or the greater time taken to rid the oven of the objectionable smells (if the latter precaution is not taken the smell permeates the food).

Thirdly, we come to electric cooking, as regards the cost of which the majority have such hazy notions. This costs for the same dinner five cents, with electricity at two cents per kilowatt-hour. On the top of the oven stands a boiler for vegetables, etc., all the rest of the cooking being done in the oven. This oven is controlled by a switch, which allows for three heats; the first of these is low, costing two-thirds of a cent per hour; the second, which is medium, costs a little under one and one-half cents per hour; the third is high heat, with all the heaters in use, the cost being a little less than three cents per hour,—with electricity, as previously mentioned, at two cents per kilowatt-hour.

The electric oven takes a very short time to heat up to its maximum temperature, and when so heated can be easily regulated by the aforementioned switches, with the result that meat can be cooked to perfection, and cakes and pastry browned, in a way almost impossible with the ordinary cooking range. It will also be found that the lighter forms of confectionery can be cooked after the current has been switched off, by means of the heat contained in the oven.

As will be seen by this article I am enthusiastically in favor of electric cooking, though I must confess that previous to my experience with this most useful form of cooking, I was rather skeptical both as regards the cost of electricity for cooking purposes, and as regards the reliability of cooking utensils, but I have now nothing but praise for the same, after having given this oven a good and fair trial.

It would probably be interesting to many readers to know whether electric cooking is as satisfactory as cooking by coal or gas. My experience has taught me that electric cooking is far ahead of its competitors for cooking purposes, owing to the very even temperature obtained, which, as every lady knows, is essential to produce satisfactory results. The only fault I have to find is the entire absence of a ventilator on the oven. The want of this ventilator means that there is always, when cooking, a fair amount of steam in the oven, and this tends to take up some of the heat which should be given to the contents of the oven. I am sure this small thing has only to be appreciated by the makers to be remedied.

On the score of cleanliness the oven has no equal; all that is required after cooking is wiping out with a damp flannel, as there is no possibility of dust and dirt as with fires, and absolutely no smell is left in the oven after cooking is done. When the oven is switched on, that is all that is necessary for the heating of it, and there is not the continual poking and building up as with the coal fire, which must be done to keep the oven to a maximum even heat, the result of all this poking being that the heat of the ordinary oven is continually varying.

From the numerous questions I have been asked with regard to electric cooking, it is clear that ladies are extremely interested in the subject, and I feel confident now that the bogy of cost is rapidly disappearing that the electric oven will soon become a household article.

Independent Telephone Convention at Decatur.

At the meeting of the Independent Telephone Association at Decatur, Ill., steps were taken toward the formation of a more permanent organization for the protection of the independent telephone interests of the state. The final words of the retiring president, Manford B. Savage, made an urgent plea for a campaign against the telephone monopolies. A committee of five was elected to work out a plan for closer union of the independent companies and to take the necessary steps toward incorporation.

As the result of an election held at this meeting, C. B. Cheadle, president of the Decatur Home Telephone Company, was elected president. Other officers were elected as follows: F. C. Woods, Galesburg, vice-president; W. W. Holiday, Jacksonville, treasurer; M. B. Farwell, Bloomington, secretary.

Navy Department Supplies.

The Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., will open bids on the dates given below for the following electrical equipment and supplies. Bidders should without delay make application to the Bureau for copies of the schedules they are interested in, being careful to give the number of each schedule. Copies can be obtained on application to the Navy Pay Office nearest each navy yard.

NAVAL SUPPLIES.

Date of Opening.	Material.	Quantity.	Delivery at Navy Yard.	Schedule No.
November 30, 1909	Appliances, wiring	Miscellaneous	Annapolis, Md.	1938
	Fittings, conduit	Miscellaneous	Brooklyn, N. Y.	1940
	Mica, India, uncut	100 pounds	Washington, D. C.	1944
	Mirrors, parabolic	6	Brooklyn, N. Y.	1940
	Motor starters and circuit-breakers	Miscellaneous	Norfolk, Va.	1948
	Rosettes	3,000	Brooklyn, N. Y.	1940
	Receptacles	1,000	Brooklyn, N. Y.	1940
	Sockets, fiber-lined	3,000	Brooklyn, N. Y.	1940
	Wire, magnet, etc	520 pounds	Washington, D. C.	1944
December 7, 1909	Machines, planing, motor-driven	2	Washington, D. C.	1962
	Planer, automatic bevel-gear, 36-inch, motor-driven	1	Norfolk, Va.	1964

Power Sites Withdrawn.

Secretary Ballinger has issued an order for the conservation of the waterpower rights on public lands. Without waiting for decisive legislation to learn what will eventually be done with many lands valuable for waterpower, the Secretary withdrew from disposition over 8,000 acres of such land located in the states of Montana, Idaho, Colorado, Washington and Wyoming and New Mexico.

This land now being in the public domain will probably be affected by legislation to be enacted during the next Congress. Until Congress decides just what is to be done with the land and the terms upon which it is to be utilized, the Secretary will keep a tight hold upon it. The land is located as follows: Six hundred and eighty-four acres on Red Rock Creek, Montana; 1,627 acres on Clark Fork in Montana and Idaho, 3,584 acres on the Gunnison River and tributaries in Colorado and New Mexico, 1,498 acres on the Klicitat River in Washington, 200 acres along the Judith River in Montana and 712 acres along the Green River and tributaries in Wyoming.

Electrical Sales Possibilities in India.

The following information concerning electrical equipments and supplies in India is furnished by Vice-Consul-General Charles B. Perry, of Calcutta: There seems to be an excellent opening in India for small electrical installations for furnishing light and running fans in country places and in places away from power stations. A number of successful installations have recently been made for twenty-five-volt lamps, one for which details are available, being arranged for thirty lights, and eight electric fans. The battery is easily contained in an unused corner, and occupies floor space of seven by four-and-one-half feet. The power house containing the dynamo, which is driven by a small oil engine, is placed some distance away. There is a large field for similar installations, and American electrical companies are urged to investigate this opening.

Control of Western Union Secured by American Telephone and Telegraph Company.

In the issue of July 3 the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN referred at some length to the preliminary reports that were then current, stating that the American Telephone and Telegraph Company had secured control of the Western Union Telegraph Company. That there was substantial basis for these reports is borne out by the announcement made on November 16 that the deal has been completed, and a controlling interest in the Western Union Telegraph Company secured by the American Telephone and Telegraph Company.

This is an important move tending toward the complete merging, or friendly alliance at any rate, of the large telephone and telegraph interests of the country. The stock of the American Telephone and Telegraph Company is largely owned by the Mackay Companies, which own the Postal Telegraph and Cable Company. Persistent rumors within the last few weeks in relation to certain deals made by James S. Brailey, Jr., tending toward the merging of certain independent telephone companies of Ohio, have asserted that there were larger interests back of these moves, and the latest reports in this connection connect the Postal Telegraph and Cable Company with these deals. Although the matter is largely conjecture there is a persistent rumor that a complete affiliation of all the telegraph and telephone companies is to be carried out.

The growth of the friendly feeling between the Western Union Telegraph Company and the American Telephone and Telegraph Company was indicated in the last annual report of the former, in which the statement was made that the holdings of stock of the Western Union in the New York Telephone Company were disposed of to the American Telephone and Telegraph Company. An outline of the Western Union's annual report was given in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of October 30.

The authorized capital of the American Telephone and Telegraph Company is $300,000,000 stock, of which about $250,000,000 is outstanding. There are also outstanding about $50,000,000 bonds convertible into stock, and in addition $53,000,000 collateral trust bonds, and about $25,000,000 of notes. The Western Union Telegraph Company has an authorized issue of about $100,000,000 stock, and outstanding bonds of about $38,700,000.

President T. N. Vail made the following statement in regard to the latest developments in the merging of the two companies.

"From the very commencement of the telephone business it has been thought that a close co-operation—the making of one business the auxiliary to the other business—would give additional public service, as well as result in large economies both to the public and to the companies.

"There is much to be gained by the joint construction and maintenance of plant, and by its common use to the greatest possible extent, but the greatest advantage would follow the placing of millions of telephone subscribers in close and reliable connection with the receiving and dispatching offices of the telegraph companies.

"While some provision for this after a manner exists to-day, a lack of harmony and co-operation between the companies and an inability to agree on methods of fixing responsibility has limited its utilization to cases of absolute necessity.

"The harmony and co-operation necessary, it is believed, can now be established and the resulting advantage made available for the public.

"The telegraph service is analogous to the mail service in that it is the collection, transmission or transportation and delivery of correspondence, the difference being that the mails transport the actual communications, while the telegraph transmits the contents of the communication from office of origin to office of destination. From the collection to the delivery of the correspondence the entire work is done by the staff of the telegraph company.

"The telephone, on the other hand, enables persons too distant from each other for ordinary conversation to engage in personal communication with each other by placing at their disposition for a time a telephone circuit.

"While there is a common feature in the use of wires strung on poles or in cables, the similarity ends there; the circuits and methods used for the telegraph and the telephone are entirely distinct and different, and each business requires its special equipment, operating force and general business organization.

"It seems not only to be good policy but a duty to increase the service and advantages to the public by utilizing present unutilized possibilities, and at the same time benefit property and increase revenue."

It is expected that changes in the personnel of the organization will be made, and it is rumored that W. H. Baker, formerly vice-president and general manager of the Postal Telegraph Cable Company, will become general manager of the Western Union Telegraph system.

Electrical Exhibition for San Francisco.

At a convention of electrical firms recently held at San Francisco the proposition of having an electrical exhibition during the coming winter was decided on. Representatives from supply houses and manufacturers throughout the United States gave this exposition their approval and promised their support.

The exposition, which is to take place at the Coliseum, from January 29 to February 5, will be one of the best in this country. It is said that out of 40,000 feet of floor space, 26,000 has already been subscribed for, and there will be no difficulty in disposing of the remainder. It is the intention of the projectors to exhibit all the electrical inventions of the past twenty years, and arrangements are being made to secure the principal features of the Madison Square Garden show.

The committee in charge of the project is: E. M. Scribner, chairman; W. W. Briggs, vice-chairman; R. B. Elder, John R. Cole and W. S. Goodwin.

Subway Extension Approved.

The New York city Board of Estimate has unanimously approved the plan of the White Plains Avenue extension to the Westchester Avenue subway route. This section runs from Bear Swamp Road to Westchester Avenue, and apparently gives the Public Service Commission a lever with which to compel the Interborough company to build an extension from West Farms to connect with the Westchester Avenue route, as the new route just approved makes it possible to connect the Westchester extension with the proposed Broadway-Lexington Avenue line.

A Texas Decision.

In a decision handed down by the Court of Civil Appeals in session at San Antonio, Texas, in the case of the Galveston, Harrisburg & San Antonio Railroad Company versus the Houston Electric Company, on appeal from Harris County, it is held that the traction company cannot be restrained from building a suburban electric line across the tracks of the appellant company. In the lower court a writ of injunction was secured, but it was later set aside.

THE BRENNAN MONORAIL SYSTEM.

SUCCESSFUL DEMONSTRATION IN ENGLAND OF A FULL-SIZED CAR.

Webster's New International Dictionary, recently published by the G. & C. Merriam Company, of Springfield, Mass., defines the term "gyroscope" in the following words: "An apparatus consisting essentially of a heavy-rimmed flywheel capable of rotation at great speed on a pair of bearings contained in or fastened to a piece, usually a ring or gimbals, so as to have additional freedom of movement in one or more directions." An encyclopedic note after the definition mentions among other uses of the gyroscope its applicability in a proposed type of monorailway. The monorailway herein indicated is the invention of Louis Brennan, the well-known inventor of the torpedo that bears his name.

A recent dispatch from London states that Mr. Brennan has at last constructed a full-sized car on his system, and a demonstration which was given last week at Chatham, England, was very successful.

Mr. Brennan's invention consists of a railway system in which the cars run without any external methods of support on a single line, or monorail, as it is called. Balancing is accomplished by means of two gyroscopes three feet six inches in diameter, weighing together one-and-one-half long tons, and rotating at the enormous speed of 3,000 revolutions a minute. The car itself is forty feet in length, ten feet wide, and thirteen feet in height to the top of the cab in which the machinery is contained. It weighs twenty-two long tons empty and has a carrying capacity of upwards of ten tons. A gasoline engine carried by the car generates the electric power by which the gyroscopes, and also the car itself, are driven.

In the demonstration at Chatham, forty persons were carried in the car which ran backward and forward along a straight monorail track and negotiated with perfect ease a sharp curve of one-eighth of a mile circle. The gyroscopes, which rotate in a vacuum and are automatically controlled as to procession by a pneumatic device, worked so perfectly that stability was maintained even when all the passengers moved over from one side of the car to the other. In every case the car automatically adjusted itself to a new balance.

The inventor claims that his new system of gyrosopic balancing will eventually revolutionize the railway system of the world. It is an admitted fact that with Mr. Brennan's system the maximum speed of railway traffic can be very largely increased, and it is asserted that the new invention makes possible a safe speed of over 100 miles an hour, a rate of traveling which is impossible under the conditions which now obtain with the present methods of railroad construction and operation. It seems hard for the average person to realize that the gyroscopically balanced car will not topple over. The action of the gyroscope, however, although in apparent contradiction of the laws of gravity, is capable of perfect explanation on mechanical principles.

Regarding his invention, Mr. Brennan is quoted by the Chicago *Tribune* in part as follows:

"When my new invention is brought down to a commercial basis, which time is not far distant, men will travel in railways with the same comfort now found on the biggest ocean liners in a perfectly smooth sea. Each train will then have its concert room with its orchestra, its promenade, its smoking rooms, its bathrooms, sitting rooms—in fact, every comfort and convenience we now find at home—for I look for the construction, as a complement to the introduction of my invention, of much larger cars than are now the rule on our railroads.

"For instance, I have drawn plans for a passenger car 100 feet in length and twenty feet wide, and I do not consider that an excessive estimate of the size of the railway coach of the near future. I predict a speed of at least 200 miles an hour, a saving in the wear and tear of rolling stock, economy in the cost of construction and maintenance.

"The principle of the invention is, of course, applicable to motor cars as well and is bound to result in the revolution of automobile construction in the next few years. As some of the advantages of the gyroscopic automobile over the present style I will say that it cannot tip over, there is much less danger of skidding, and it will take a much greater incline and there is an absence of side motion.

"The characteristic feature of this system of transport is that each vehicle is capable of maintaining its balance upon an ordinary rail laid upon sleepers on the ground, whether it is standing still or moving in either direction at any rate of speed, notwithstanding that the center of gravity is several feet above the rail and that wind pressure, shifting of load, centrifugal action, or any combination of these forces may tend to upset it.

"Automatic stability mechanism of extreme simplicity carried by the vehicle itself endows it with this power. The mechanism consists essentially of two flywheels rotated directly by electric motors in opposite directions at a high velocity and mounted so that their gyrostatic action and stored-up energy can be utilized. These flywheels are mounted on high-class bearings and are placed in exhausted cases, so that both air and journal friction are reduced to a minimum, and consequently the power required to keep them in rapid motion is small.

"The stability mechanism occupies but little space and is conveniently placed in the cab at one end of the vehicle. Its weight is also small, about five per cent of the total load being considered an ample allowance for the first vehicle.

"The road wheels are placed in a single row beneath the center of the vehicles instead of in two rows near the sides as usual and are carried on bogies or compound bogies, which are not only pivoted to provide for horizontal curves on the track but for vertical ones also. By this means the vehicles can run upon curves of even less radius than the length of the vehicle itself or on crooked rails without danger of derailment.

"Everything points to great economy resulting from making the vehicles wider in proportion to their length than on ordinary railways.

"Flying lines of railway can be laid with great rapidity over uneven ground with slight expenditure of labor. Specially designed building vehicles are also planned on the monorail principle and equipped with electric gear for handling the rails, being kept at the rail head for the purpose. It is confidently anticipated that working in this manner it will be possible to keep up with an army on the march and supply it with all its requirements.

"Bridges are of the simplest possible construction, a simple wire hawser stretched across a ravine or river being all that is necessary for temporary work. These hawsers can be built up on the spot from separate wire rope strands, so that the transportation of them becomes an easy matter. Strange to say, the lateral swaying of the hawser does not disturb the balance of the vehicles and the strongest winds will fail to blow them off. In other cases of bridge building a single row of piles with a rail on top suffices or a single girder carrying the rail may be conveniently used."

Other uses of the gyroscope have already been exploited commercially, in the

Obry gear, which is used for automatically steering the well-known Whitehead torpedo, in a device recently invented by Dr. H. Anschütz-Kämpfe, designed to replace the mariner's compass or to serve as a check on its accuracy, in a contrivance invented by Dr. Otto Schlick to prevent rolling of ships at sea (see editorial pages), and in various proposed methods for automatically balancing aeroplanes and dirigible balloons.

Mr. Brennan has apparently demonstrated that his invention is practical, and it will be interesting to note how far it will be adopted, and whether the traveling public will avail itself of the opportunity to travel at a rate of speed which is even more revolutionary than was the steam locomotive over the earlier and more primitive methods of transportation.

Electric Locomotive with Edison Accumulators.

In order to avoid the disadvantages of lead accumulators, their weight, and the development of odors and fumes, the firm of F. Schichau has chosen the Edison accumulator as a source of power for the electric locomotive built by it. A small, normal-gauge locomotive, 7.8 metres in length, including buffers, was built for experimental purposes. The accumulators are installed in the front and rear in the usual way in spaces protected from outside influences by tight covers.

The battery consists of 408 Edison cells, type H45, of 280 ampere-hour capacity, so that the average discharge tension is 501.8 volts. Groups of four cells are contained in wooden frames, the individual cells being joined by rigid connections. The dimensions of the cells are: Length, 170 millimetres; width, 128 millimetres; height, 310 millimetres, without binding posts. The entire weight of the battery, including wooden frames, is about 5,900 kilogrammes; that is, only 14.5 kilogrammes per cell. Each cell consists of a thin-walled, heavily nickeled iron vessel, with projecting binding posts; an opening for filling; and a valve for letting out the entirely odorless gases. The vessel encloses a number of nickel-plated iron plates with perforated pockets of sheet steel. These pockets contain the active substance, which in the positive plates consists of nickel oxide and in the negative plates of iron oxide pressed into them under very high pressure. There is one negative for every two positive plates. The distance between the individual plates is only 1.5 millimetres, and they are insulated from each other by thin hard-rubber rods. From the bottom and walls the plates are insulated by hard-rubber disks. The electrolyte is a twenty-one per cent solution of caustic potash. According to experience, the life of the plates is equal to over 150,000 car-kilometres.

The further equipment of the locomotive consists of two series motors of thirty-five horsepower each, which drive the axles by means of simple gear transmission, a controller, measuring instruments, automatic cut-out, and hand brake. The total weight of the locomotive is 19.5 tons; that of the wagon frame being 9.8 tons; of the motors and controlling apparatus 3.8 tons, and of the battery 5.9 tons.

The locomotive, drawing a car of 30,000 kilogrammes, traveled 212.5 kilometres on a single battery charge. At the conclusion of the trip the battery still had a tension of about 468 volts, which showed that it could have traveled another fifty kilometres. The tests with this experimental locomotive were so favorable that the above-named firm has concluded to build and introduce locomotives of this type.—*Abstracted from Elektrotechnische Zeitschrift (Berlin), October 21.*

Chicago Electric Club.

The speaker on the occasion of the regular weekly midday meeting of the Chicago Electric Club on Wednesday, November 10, was Millard B. Hereley, traction expert of the city of Chicago, who gave an interesting talk on the traction situation in Chicago.

After duly apologizing for his title, Mr. Hereley started with the time when the only means of transportation were the horse car and other horse-drawn vehicles, and briefly reviewed the traction situation up to the preesnt time. For many years the people of Chicago tolerated a system which was far behind the times, and it was not until 1907 that the now well-known ordinances were passed by the City Council which meant a new traction system for Chicago.

Although a great deal has been accomplished so far, as is evidenced by the many miles of new track representing an expenditure of millions of dollars and the large number of modern cars, Mr. Hereley made many suggestions for the betterment of the entire system. For a remedy of the surface traction problem, he suggested that the north and south lines be through-routed. As an example, that the Kedzie Avenue, Western Avenue, Halsted Street and similar lines be operated from the extreme southern boundaries to the northern boundaries of the city. Also that lines operating east and west be terminated before crossing the downtown north and south lines.

Regarding the elevated situation, the speaker referred to the recent controversy regarding the loop problem, and said emphatically that the loop should be abolished. Another question of vital importance which is pressing upon the community and which must be answered in the near future is the proposed subway. However, Mr. Hereley refrained from giving any information on that subject.

The points emphasized in the address as tending toward the betterment of the traction situation were: A three-level system consisting of subways, elevated lines and surface lines, the elevated system to handle the long-haul traffic, the surface lines to handle the short-haul traffic, and the subway to accommodate the overflow traffic from the other lines; a single ownership for all lines; universal transfers; through routing, and abolishment of the present elevated loop in the business district.

In a conclusion bordering on the dramatic, Mr. Hereley said the present condition of the surface and elevated lines is holding Chicago as in the coils of an anaconda. A great steel corset encircles her waist and cuts off her respiration and circulation and impedes her progress. This great corset must be torn from her cramped and deformed body, so that healthy development, north, south and west, may be made possible. When this is done Chicago's business center will spread like a green bay tree. Her urban circulation will become normal and her rich commercial blood will flow through her veins like the torrent of a Niagara, and Chicago, the jeweled queen of the mighty West, with her motto "I Will" emblazoned on her crown, will stand erect, refulgent in the view of the world, full of hope and promise and commercial power.

New Bridge Franchise.

The Public Service Commission has approved the franchise granted by the New York city Board of Estimate to the South Shore Traction Company to construct a trolley line in Queens and run cars across the new Queensboro Bridge.

After the Commission had granted the certificate of necessity and convenience to the company, the Board issued the franchise. The Commission then refused to approve it, objecting to the terms.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

THE ELECTRIC SYSTEM OF THE GREAT NORTHERN RAILWAY COMPANY AT CASCADE TUNNEL.

The two-hundred-and-fortieth meeting of the American Institute of Electrical Engineers was held on Friday evening, November 12, at the Engineering Societies Building, New York city, with President Stillwell in the chair. After the meeting was called to order Secretary Pope announced that at the meeting of the board of directors held in the afternoon, twenty-eight associates were elected and one associate transferred to grade of member.

The president then made a few introductory remarks prior to introducing the speaker of the evening, Dr. Cary T. Hutchinson, of the Great Northern Railway, who was to read a paper on "The Electric System of the Great Northern Railway Company at Cascade Tunnel." He said that it is certainly a fact of great interest that in this year 1909 a three-phase railway installation of magnitude had been completed and put into commercial operation in the United States. Polyphase motors were brought to this country in 1888. Those which arrived in that year were at about one-quarter horsepower, but none of them ever succeeded in producing that amount of power. Serious efforts were made at that time by American engineers, connected with one of our manufacturing companies, to adapt this motor to railway purposes, but the conclusion reached was that the constant-speed characteristic of the motor rendered it unsuitable for that purpose. He reviewed the development of the electric traction problems in Europe, and continuing, said that in the United States but little attention was paid from 1890 until recently to the practical application of the polyphase motor to railway purposes. It received during that period, it is true, very serious and careful study, but the conclusions reached were negative, and it was not introduced in commercial service in this country. In the United States today, there are three different electric systems operating electric traction of the heaviest kind, direct-current system, the single-phase alternating, and the three-phase alternating-current systems. All of these are doing their work not only successfully, but in a manner that shows a marked improvement, as compared with the steam locomotives which they superseded. The railroad managements of the country are beginning to awake, and are asking the question—which is the best system for general railway work? and that question, Mr. Stillwell said, is going to be answered by the electrical engineers. He then introduced Doctor Hutchinson, who made a few introductory remarks before beginning the reading of his paper, an abstract of which follows:

The first three-phase installation on a trunk line railway in the United States was put into operation early in June of this year at the Cascade Mountain Tunnel on the Great Northern Railway in Washington, about one hundred miles east of Seattle. In general the plant supplying current for this system comprises a hydroelectic generating station operating under a head of one hundred feet, having a capacity of approximately 5,000 kilowatts in generators at 6,600 volts and twenty-five cycles; a transmission system at 33,000 volts delivering energy to the substation, where it is transformed to 6,000 volts, at which pressure it is supplied to the overhead conductors and to the locomotive by way of an overhead trolley; on the locomotive the pressure is reduced by three-phase transformers to 500 volts for the supply of the four three-phase motors with which each locomotive is equipped.

The Great Northern Railway crosses the Cascade Mountains through a tunnel 13,873 feet long. The operation of this tunnel with steam locomotives was at all times difficult and frequently very dangerous on account of the heat and smoke from the locomotives. The temperature in the locomotive cab was almost unbearable. The tunnel is lined with concrete throughout its length and is in good condition. The entire tunnel drips more or less from condensed steam just after the passage of a train, but is comparatively dry at other times. The temperature changes at the top of the tunnel are very rapid, varying the atmospheric temperature several hundred degrees from the heat of the locomotive exhaust. For many reasons this tunnel is a limiting feature to the capacity of the Great Northern Railway for hauling freight across the mountains. The plant described is designed for use over the entire mountain division by extending the system of conductors and building additional stations.

The principal data of the locomotives are as follows: Total weight, 230,000 pounds, all on drivers; two trucks connected by a coupling, each truck having two driving axles; a three-phase motor connected by twin gears to each axle; synchronous speed of motor 375 revolutions per minute, giving a speed of 15.7 miles per hour at no load and dropping to fifteen miles per hour for a load corresponding to a one-hour rating. The motors are wound for 500 volts and are completely enclosed and air cooled. The specifications of the motor required an output of 250 horsepower continuously for three hours, with seventy-five degrees Centigrade temperature elevation when supplied with not more than 2,000 cubic feet of air per minute. Each locomotive is equipped with four three-phase induction motors wound for 500 volts at the primary or stator; the motors are completely enclosed and air cooled by forced air circulation from a large blower. They are suspended from the axles in the standard manner, except that they are geared at both ends of the armature shafts, this being made necessary by the low speed and high torque required, as it was not considered safe to use a single pair of gears. The locomotive carries two three-phase air blast transformers, having a nominal rating of 400 kilowatts each, transforming from 6,000 volts to 500 volts normal, or to 625 volts by the use of taps. The continuous capacity of the transformer is not as great as that of the motors, although it is fully up to the specifications, and it may be that the quantity of air to the transformer will have to be increased when the locomotives are put in continuous service. The control system of each motor is separate; the circuits branch from the transformer and are independent from the resistances. There are fourteen conductors in each motor circuit, fifty-six in all. The pilot control is in duplicate and there is one switch at each end of the locomotive. There is a clear aisle on each side of the locomotive from end to end, all of the apparatus being assembled in the center of the cab.

The locomotive is of the articulated or hinged type, having four driving wheels on each half of the running gear, and is without guiding wheels. The running gear is comparable to the Mallet type of steam locomotive, in that the hinge sections are so connected that they tend to support each other vertically and guide each other in taking the curves. The cab is carried on the trucks through center pins on each bolster, the center pin on one end having a slight longitudinal sliding motion to allow for variation in the distance between truck center pins in taking curves. The cab extends the entire length of the platform.

The energy supply for the locomotive is derived from the Wenatchie River, which flows along the line of the railway for a distance of some twenty miles. The power house is designed for three main units and two exciter units. There are now installed in the power house two main units, each being a turbine rated at 4,000 horsepower directly connected to a three-phase generator of a capacity of 2,500 kilo-volt-amperes, at 6,600 volts and twenty-five cycles. These machines are designed to have very large overload capacity and operate at a low flux density. There are two exciter units, each having a nominal capacity of 125 kilowatts. These units also have a large overload capacity. The power house contains four transformers for raising the pressure to 33,000 volts, each of nominal capacity of 833 kilowatts and guaranteed to operate 100 per cent overload for one hour with a low rise in the temperature. The switching apparatus is of the usual type.

The transmission line extends to the substation, approximately thirty miles away, following the railroad all the way. In the design of the line, as in other features of the work, the aim was to secure apparatus and types of construction giving promise of the greatest reliability, in order that there should be as few links as possible in the chain from the power house to the locomotive that would be liable to derangement. The overhead construction in the yards consists of wires supported at intervals of one hundred feet. Multiple track supports consist, for each phase, of a steady span supported by and insulated from the cross catenary span, both spans being secured to cross arms on the poles by means of porcelain petticoat strain insulators. The wires for the two respective phases are three feet apart. The wires of the same phase for the different tracks are insulated from each other by means of a wood breaks and porcelain link insulators in series. The lighting system installed in the tunnel consists of five transformers of four kilowatts capacity, each placed in refuge chambers. Incandescent lights are spaced at intervals of fifty feet and are connected in sets of five in series across the 500-volt system.

The electric service was started on July 10 last, although one or two trains had been handled previously. From that time to August 11 practically the entire east-bound service of the company had been handled by electric locomotives. During this period there were 221 train movements, of which eighty-two were freight, ninety-eight passenger and thirty-two special. In each case the steam locomotive was hauled through

with the train. The total tonnage hauled was 275,000 tons.

In conclusion, the following advantages and disadvantages of the three-phase system for traction use are given: (1) Maximum electrical and mechanical simplicity. This point is of great importance and was one of a number of reasons for using three-phase system. The motors will stand any amount of abuse and rough use. (2) Greater continuous output within a given space than can be obtained from any other form of motor. This is shown by comparison with other electric locomotives, which is due to the fact that the losses can be kept lower in the three-phase motor than in any other type. (3) Uniform torque. This is important, particularly at starting. The three-phase motor will work to a three or four per cent greater coefficience of adhesion than a single-phase motor of fifteen cycles. (4) The possibility of using twenty-five cycles. This is important, as it leads to a less cost and a better transformation of power-station apparatus; moreover, it is standard and the power supply can readily be used for other purposes as well as for traction; a commercial supply can be provided. (5) Constant speed. This is ordinarily stated as a disadvantage of the three-phase motor, but it is a distinct advantage in mountain service, particularly the limitation of the speed on down grades. It has also an advantage on up grades—meeting points can be arranged with greater definiteness. It is generally believed that the impossibility of making up lost time with a three-phase motor will be a decided drawback to its use. This would be true if there were the same liability to lose time with three-phase motors, but when a train can be counted on to make a distinct speed without regard to conditions of track or of its load, there is less liability to lose time. (6) Regeneration on down grades. This matter has been discussed since the earliest days of electric traction, but has not been, up to the present time, put into practice. Although this result can be attained with other forms of motors, yet it is most perfectly attained by three-phase motors, there being no complications involved. This is of importance in reducing the power-house capacity required for a given space, although no doubt the saving in power-house capacity will not be as great as indicated by theory, owing to the various emergencies that must be provided for; nevertheless, there will be a material saving. (7) Excessive short-circuit current is impossible, and consequently destructive torque on the gears and driving rigging is eliminated. There will be no necessity for the complication of the friction connection between the armature and driving wheels, as in the recent large direct-current locomotives. (8) Impossibility of excessive speed. Even when the wheel slips the speed remains constant. Therefore, the maximum stresses put on the motor are less and are more accurately known than with any other form of motor.

On the other hand, the principal disadvantages of three-phase motors for traction use are commonly stated to be: (1) The constant speed. This is rather an advantage for this class of service. (2) Constant power. The fact is that the motor is a constant power motor, and, therefore, requires the same power at starting and accelerating as at full speed. (3) Small mechanical clearance. In this particular motor the clearance is one-eighth of an inch, which is ample for all practical purposes. (4) Inequality of load on several motors of a locomotive due to differences in diameter of driving-wheels. To meet this an adjustable resistance is included in the rotor of each motor. The motors are then balanced up and no further attention is required as long as the wear on the driving-wheels is approximately the same. (5) Low-power factor of the system. This does not seem to be borne out by practice. The power factor, as shown by the switchboard instruments in the power house, is eighty-five per cent. (6) Two overhead wires. There is no doubt that two wires will cause more trouble than one, and in case of complicated yard structure, it might not be practicable to use two overhead wires.

The president then called upon W. S. Murray to open the discussion.

Mr. Murray said that he was a "single-phase man;" but as far as the Cascade tunnel is concerned, he was heartily in agreement with Doctor Hutchinson, because the physical conditions of the road required a three-phase system. The reasons for the application of three-phase are exceedingly simple. Any piece of trackage, be it one mile or three hundred miles, be it zero grade, up to a percentage of grade that admits of adhesion of the locomotive, only with trains upon it, with no stops, and even with conditions of stops where the acceleration is exceedingly low, under such conditions most of the engineers in this country would adopt three-phase. The single-phase motor is admittedly heavier than the three-phase motor for the same output. Therefore, three or four per cent greater adhesion is not important. Now, the single-phase motor is admittedly heavier than the three-phase, for a certain amount of capacity, and therefore this lack of adhesion, if that fact exists, is taken care of by its excess weight. It is unfortunate that the single-phase motor weighs more, but it does, and takes care of that case. The twenty-five-cycle on single-phase can be used, but the three-phase secures less costly generators. This is offset, however, by less complicated switchboards. It is not greatly more expensive to use three-phase rather than single-phase generators for single-phase distribution, and the dampened field rather cuts down the rising voltage on the idle phase, making it perfectly possible to develop three-phase current for commercial requirements.

Bion J. Arnold said that his difficulty for the last five years had been, not in handling single-phase or three-phase, direct-current or alternating-current systems, but rather in handling men and other elements, which enter, not into the construction of railways or in the operation of them, but in the continuance of them in financial existence, or endeavoring to point out ways whereby they could remain in existence and prevent them from being financially eliminated. He said that last summer, while on a trip, he found he was only a few miles from the Cascade tunnel, so went over and rode through the tunnel several times on the locomotives. The system operated as successfully as any direct-current or single-phase installation he had ever seen. It had the objection of the double overhead conductor, and the yard was necessarily somewhat complicated on that account. That was one of the principal reasons why Mr. Arnold chose the single-phase for the tunnel between Detroit, Mich., and Sarnia, Ont. That element, and others, which seemed to show an economy in favor of the adoption of the single-phase system, together with the saving in investment which seemed to be made under the circumstances, caused him to adopt the single-phase installation for that system, and at a time when single-phase installation had not been tried on heavy traction work.

F. N. Waterman said that, as one who has advocated the consideration of three-phase motors for railway work, he is particularly gratified by the evidence of its advantageous application as set forth in the paper of the evening. He called attention to one property of induction motors not exhibited in the present instance, because only one train is operated, namely, the action of moving trains as flywheels to keep down the peaks or minimize the fluctuations on output of the central station. The present system operates only one train at a time, and therefore it is impossible to realize that unique feature of induction motors.

J. H. Davis, electrical engineer, Baltimore & Ohio Railroad, said that the plant described by the author makes an epoch in the history of heavy railroad electrifications in the United States. It is the first attempt in this country to use the three-phase induction motor for handling heavy passenger and freight trains on a trunk-line railroad. The paper is replete with interest, as it covers, in a general way, all of the principal features of the plant from the utilization of an available waterpower to the locomotives and their operation. We are especially impressed with the importance of the electrical engineer's decision in recommending the adoption of a certain system of electrification. His decision is second in importance only to that of the engineer locating the railroad. A decision to use this or that system of electrification for a certain purpose, as, for instance, handling heavy traffic over a mountain division, will, of necessity, have great weight in determining the system of electrification to be used when other divisions of the road are electrified. The system thus adopted may or may not be that which is best suited for the desired extension. If the entire road is

eventually electrified, one system of electrification should be used throughout, although this system may not be best adapted to all of the various conditions to be met. Therefore, the system adopted should be that which is best adapted to the requirements of the road as a whole. The necessity for interchange of equipment from one division to another is well known, and in meeting this requirement the electrical engineer can best secure simplicity of equipment by confining himself to one system of electrification. The gain in this direction will be more than sufficient to offset the loss due to the adopted system not meeting in the best way some of the conditions.

L. R. Pomeroy, of the American Locomotive Company, in the discussion stated that he made an examination of the Cascade Tunnel situation to determine the possibilities of electrification, and subsequently has been furnished with road tests of locomotives over the road described, which were presented. From these figures Mr. Pomeroy presented the deduction that the percentage of difference in favor of electricity was fifty-eight per cent. Also that the total amount saved by using electricity over this section is $268,769, and this amount capitalized at five per cent, represents $5,375,380. This amount alone, and not figuring on other savings, such as train crews, reduction in train mileage with the same tonnage, the advantage of a great increase in capacity, would go to show that such a mountain section comes very near being a situation where we can accomplish by electricity what is now impossible under steam conditions.

F. S. Denneen, of the Ohio Brass Company, said that he had quite a little to do in laying out the detail of the overhead construction, and in that capacity was acting for the manufacturers who supplied the materials. The trolley construction is what is generally termed a direct suspension type, that is, the trolley wire is not supported by any auxiliary overhead wire, and the reason for selecting this direct suspension instead of going into the more elaborate catenary types now so popular, was that there is a necessity for providing two wires over each track, with a voltage of 6,600 between the wires, and the same voltage between either wire and ground, and therefore the installation of auxiliary supporting wires would greatly complicate the problem of insulation, not only that, but the danger of cutting down the road and interrupting service for any of a great many possible causes, would be greatly increased, and therefore he decided to go to this self-supporting type of trolley. The overhead structure on the single track yard consists of a bracket, each phase is supported by an independent span, and auxiliary insulation is provided in every case, that is, the major insulation may be said to consist of two heavy porcelain strain insulators. The porcelain strains are rated for 10,000 volts, while wood break strains might be rated at 3,200 volts, or more. In certain parts of the yard it was necessary to provide overhead construction for as many as six tracks. Wires of the same phase are carried upon one cross catenary, while those of the opposite phase are carried upon another one; there is insulation between the wires of the same phase over different tracks. This was done in order to maintain the tracks entirely independent, and make it possible to cut out any one track or any set of tracks. Dr. Hutchinson refers to the trouble experienced at the intersection of lines due to the trolley leaving the wire, this trouble occurring as the trolley wheel crosses the pan casting. At the time the layout was originally made a scheme was considered for turning a tongued portion in the pan so as to carry the wheel across in the proper direction, but this complicated the arrangement and was not followed. When the original tunnel was made the trolley wires were set five feet apart, but after the whole layout had been worked out and approved by the railway engineers, the officials of the road decided that they wanted the entire central part of the tunnel, or the entire overhead, in the center, clear, so it was necessary to set the trolley wires out to a separation of eight feet within the tunnel, which made it rather bad in a great many ways. The clearance between the side wall and the trolley on either side was only fourteen inches, and it was desirable to prevent the trolley from swinging, and it was necessary to provide double insulation throughout, so the problem was not an easy one.

W. I. Slichter, of the General Electric Company, contributes a written discussion wherein he stated that the principal characteristic which differentiates American from European railway installations is size. In the locomotives under consideration it was necessary that there should be developed a tractive effort about three times as great as that developed by the foreign locomotives and the practice of pushing a 2,000-ton train up a two per cent grade required that that tractive effort should be applied gradually, steadily and continuously, as any sudden variations in a tractive effort of this large value would almost certainly result in breaking a train in two and possibly in causing a wreck. Thus, the control system of such a locomotive is a very vital feature. There can be no reduction in the tractive effort after it is once applied, and there must be sufficient control steps so that successive increments of tractive effort are not so great as to slip the wheels or strain the draw-bars to a dangerous extent. In this particular case the character of the service and the low speed of the locomotive eliminated the necessity of having more than one running speed. The problem was then to provide a control system which would give a steady acceleration and yet provide for running at fractional speeds for short intervals of time such as fifteen minutes as contrasted with continuous running. This is accomplished by using plain rheostatic control in the secondaries of the motors, varying the resistance by contactors and providing sufficient capacity in the rheostats to permit of running for fifteen minutes at full load. The control system consists of fourteen contactors per motor, five of which are in the primary, there being one contactor on one phase and two on each of the other two phases to provide for reversing the motors. This leaves nine contactors in the secondary to give thirteen steps, which is accomplished by a scheme of dividing the resistances into two or three groups, each having its contactor, and these groups are brought into different combinations so that each group is used over and over again, some times in series, some times in multiple with the others, and not left idle after being used once. A separate and independent set of resistances is provided for the secondary of each motor to avoid the tendency of the motors to exchange current and "buck" when they are all connected in multiple to one set of resistances. The advantage of the induction motor, due to its peculiar adaptability to regeneration, is best illustrated by considering the amount of energy which is regenerated and which would have to be dissipated in rheostats otherwise. To hold a train having a gross weight of 600 tons on a 2.2 per cent grade would require a resistance capable of absorbing 650 kilowatts per locomotive for the time during which the braking occurred. This corresponds in size of rheostats, to the condition of running continuously at a speed of four miles per hour with an input of 460 amperes per

motor and a tractive effort per locomotive of 37,500 pounds.

C. L. de Muralt, after commending Dr. Hutchinson's paper and the three-phase system in general, said that a point emphasized particularly in the paper of Dr. Hutchinson is that the efficiency of the three-phase system is extremely high. The second point is that the recuperative feature has also been rather underestimated. The paper shows conclusively that the regeneration of the train on a down grade is fully up to the calculated results. There is no reason why actual experience should disagree with calculations on this subject. The paper does not bring out the full value of the recuperation, it cannot, because it is too limited an application. When the road is extended and operates over a long distance it will bring out the full value of the recuperation.

Calvert Townley, in the discussion, stated that he wanted to mention one point which seems not to have had as much emphasis as it really should have had. The various advantages of electric traction over steam have been considered for a long time, and predictions made of possibilities when the water powers of the western mountains were used to supply power for the electrification of our mountain roads, but here is a case where the installation has actually been made, where a large steam railroad system, backed by abundant capital and officered by men standing high in their profession has gone to work and electrified a section of their line at a very heavy expense. He said that question of the type of apparatus, its performance, etc., in which electrical engineers are naturally very much interested, important though it may be, is really a secondary matter in this particular case. It seems that the greatest importance attaches to the making of this installation. It means more than any mere question of the design of the machinery, because this installation will be successful, it will be extended, the road putting it in will find that it has been to their advantage to substitute electricity for steam, that entirely aside from the questions of economy of operation on which we have had some interesting figures, on other and broader questions in operation that will be shown to be of such importance that this installation will mark a distinct advance towards the electrification of these important trunk lines.

C. P. Steinmetz said that it is now something over fifteen years since the first three-phase induction motors were applied to railway circuits. At that time the single-phase commutator motor had been designed for railway work, had been designed some years previously, but had not been carried through, because no frequency then existed low enough to make this type of motor suitable. Very much work was done on three-phase induction motors, a number of equipments filled, and very high hopes were entertained in those early days. At the same time, however, the rotary converter was successfully developed and introduced into the industry and gave the direct-current railway motor such an extension in the distance to which it could be used, that the direct-current railway motor was capable of taking care of all the railway work for practically unlimited distances, and in view of this the three-phase induction motor development in this country did not progress as we hoped it would. Ultimately the three-phase induction motor also has reappeared and found successful application. The advantage of the three-phase induction motor is the simplicity and resulting reliability, the uniformity of current and the greater output. These are the characteristics of polyphase machinery in the polyphase generator, motors, etc.—the main characteristic of the three-phase induction motor, however, is that it is a constant feed motor. All other characteristics result from the constant speed, and that follows that its efficiency of acceleration is relatively low, it consumes the same amount of power in turning around slowly as it consumes when running at full speed at the same given current. The result of the constant speed feature is also the regenerative feature, that above synchronism it goes into regeneration automatically. The constant speed feature limits to a certain extent the present application of the three-phase motor in railway work. It is well suited for mountain divisions, for running continuously with heavy torque, positive or negative. For general railway work, however, as it is at present carried out in our country, the three-phase induction motor locomotive is not as well suited as the direct-current locomotive or the single-phase commutating machine, for the reason that the direct-current series motor or the alternating current commutating motor can replace the steam locomotive in our present railway operation, while the three-phase induction motor locomotive can at best efficiency replace the steam locomotive and operate the railway system in the same manner as it is operated now, but it requires a rearrangement of the method of operating to a constant speed service. When considering the method of operation, we have to investigate whether this particular method is really inherent in the problem, is a necessary feature of the desired results, or whether it is an incidental feature of the particular apparatus we use. The steam locomotive is a constant power motor. It gives the same power irrespective of the speed—the power is limited by the steaming capacity of the boiler, and whether you climb a heavy grade or run on a level track, you have that particular power limit, and that has fixed the present method of railway operation. It was not the anticipation of making up for lost time, it was merely that the locomotive had to slow down on the up-grade, because it could not keep up steam and could run faster on a level track. As regards the shunt motor limitation, Mr. Steinmetz called attention to one particular curiosity—when speaking of the shunt motor, the induction motor, we always specifically exclude from its field of operation, the rapid transit service—rapid transit is that operation where the series characteristic is especially necessary and where the shunt motor is especially unsuited. The most extreme case of this constant acceleration of heavy torque and never doing anything else, the most extreme case of rapid transit, is the high-speed passenger elevator operated by the shunt motor and induction motor for the sake of reliability and capacity of operation.

Frank J. Sprague was present and entered into the discussion by saying that he is not the advocate of any particular system, or the disparager of any particular system. He mentioned the three main electric installations on trunk lines in this country, and said that at each of these places the steam locomotive was under the maximum disadvantage, under the vilest possible conditions of operation. Electricity offered a remedy, and according either to the beliefs of the designers or the ambitions of the various manufacturing companies, or the engineers of the railroad companies, the three distinct systems were adopted. In each of these operation continues successfully. There are higher speeds, higher capacity, greater safety and greater cleanliness, which are the characteristics of operation, and he thinks engineers have every reason to have hope, and feel gratified, because each system of these three particular installations has overcome many difficulties incident to steam operation, and are giving creditable results, but neither of these is

a complete trunk line, the Cascade, not more than the others.

Dr. Hutchinson concluded the discussion by saying that most of the criticisms that have been made can be answered in the general statement that he was not describing this as a system applicable to any condition other than that to which it was applied. This system has been put in for a particular purpose, to meet a particular situation. It may or may not be good for other conditions. He said that he believed it would be good for the entire mountain, but that has not been tried. As to whether, generally speaking, it is better or worse than other systems, that is immaterial.

Newly Elected Associates, American Institute of Electrical Engineers.

At the directors' meeting, held in New York on Friday, November 12, twenty-eight applicants were elected to membership in the American Institute of Electrical Engineers, as Associates. The list of Associates so elected is as follows:

Anderson, Gustave Emil, assistant installer, Automatic Electric Company, Morgan and Van Buren streets, Chicago, Ill.

Bailey, Edgar Lawrence, electrical expert, General Electric Company; residence, 119 East Erie street, Chicago, Ill.

Beal, Henry M., superintendent, Citizens' Light, Heat and Power Company., Montgomery, Ala.

Bell, Robert James, electrical engineer, Chicago & Southern Traction Company, Chicago; residence, 91 154th street, Harvey, Ill.

Campbell, George, electrical superintendent, R. Simpson Department Store; residence, 108 Emerson avenue, Toronto, Ont.

Cline, William Hamlen, motor engineer, General Electric Company; residence, 101 North Common street, Lynn, Mass.

Condon, Casimir C., superintendent of construction, Condon Construction Company, 1531 Unity Building, Chicago, Ill.

Cox, John William, chief engineer, Columbus & Hocking Coal and Iron Company, Kachelmacher, Ohio.

Coxey, Albert Childs, electrician, Pittsburgh Plate Glass Company, Crystal City, Mo.

Frickey, Royal Evarol, electrical engineer, Northern California Power Company, Redding Cal.

Garnier, Edward Jacob, electric section foreman, Indiana Steel Company; residence, 767 Madison street, Gary, Ind.

Hillebrand, Phillip Henry, division foreman, Marysville Power Division, Pacific Gas and Electric Company, Marysville, Cal.

Karow, Edward, Jr., designing engineer, General Electric Company, Schnectady, N. Y.

Knapp, Martin Vale, superintendent of electrical department, The Union Utilities Company, Morgantown, W. Va.

Marcell, Lawrence Powell, electrical engineer, The National Railways of Mexico, Aguascalientes, Mexico.

Murray, William Wallace, superintendent, Dreamland, Coney Island; residence, 92 Montrose avenue, Brooklyn, N. Y.

Myers, Laurence Joseph, consulting electrical engineer, 228 West Borden avenue, Syracuse, N. Y.

Neel, Blanton, enginner, Chattanooga Electric Company; residence, 215½ Vine street, Chattanooga, Tenn.

Nichols, Charles Hart, consulting engineer, 11 East 24th street; residence, 63 West 127th street, New York city.

Nipper, Ainsworth M., superintendent electric light and power, Board of Public Works, Hannibal, Mo.

Orr, John, professor of engineering, Transvaal University College, Johannesburg, S. A.

Rice, Homer Coke, sales engineer, Westinghouse Electric and Manufacturing Company, 209 Central Building, Seattle, Wash.

Rutledge, Henry Benson, construction foreman, General Eelctric Company, Union Trust Building, San Francisco, Cal.

Tillson, Percy E., assistant engineering department, Bell Telephone Company of Pennsylvania, Philadelphia, Pa.

Wadsworth, George Reed, consulting engineer, 19 Congress Street, Boston; residence, Brington Road, Brookline, Mass.

Wall, Samuel Smith, superintendent, Town of Pulaski Light and Water Department, Pulaski, Va.

Warren, William Douglas, president and manager, Warren Electric Company; residence, 117 South Water Street, Trinidad, Colo.

Wyrick, Byron M., superintendent construction and equipment, Postal Telegraph and Cable Company, of Texas, 243 Main Street, Dallas, Tex.

At the same meeting Robert Dale McCarter, consulting engineer, London, England, was transferred to the grade of Member.

Inductance in Resistance Coils.

In an article by S. Leroy Brown in *The Physical Review* for October, on "The Residual of Inductance and Capacity in Residual Coils," the author arrives at the following conclusions: (1) A parallel wire standard of resistance can be constructed which is free from residual inductance when used with interrupted, steady current, or with alternating current of moderate frequency. (2) The outstanding difference between inductance and capacity in resistance coils can be measured by comparison with this parallel wire standard. (3) A standard coil, made by twisting the wires together and separating consecutive turns, is not completely compensated for inductance and capacity when capacities of a few hundred micro-microfarads are to be measured. (4) Capacities and inductances of small or large values can be measured with alternating current and an alternating-current galvanometer. The values are calculated from formulas which involve only the resistance, inductance and capacity of a single circuit and the frequency of the applied electromotive-force.

The new electric-railroad mileage built in 1908 in the United States, Canada and Mexico was 1,258 miles, computed as single-track road. New York state takes the lead in mileage, with 184 miles, closely followed by Ohio, with 171 miles.

A Vibrating Speed Indicator.

This device, which is manufactured by the Siemens & Halske Company, under the Frahm patents, is based on the resonance principle and utilizes the balancing defect existing in the rotating mass of all machines on account of the fact that the center of gravity of rotating systems can never be placed exactly in the center of the axis. The small, often scarcely perceptible, shocks are a direct function of the number of revolutions of the shaft and

VIBRATING SPEED INDICATOR.

are perfectly sufficient to set the apparatus in action. If a tuning fork is mounted on a machine, it will receive a small impulse at each revolution, but will respond to these impulses only when they coincide exactly with its natural period of vibration. If several tuning forks of different notes are mounted together it will be possible to make the number of revolutions correspond to their known notes. The construction of the practical apparatus is shown in Fig. 1. The tuning forks are replaced by thin, flat steel strips bent at right angle at their heads and painted

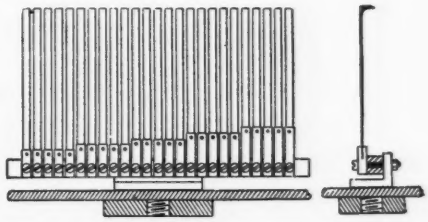
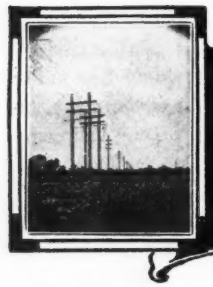


FIG. 1.—VIBRATING ELEMENTS OF SPEED INDICATOR.

white in order to render them more visible. These so-called resonance tongues are roughly tuned by varying their lengths, the finer adjustment being made by a quantity of tin solder under the bent heads. The apparatus receives a larger or smaller number of such resonant tongues according to the limits of speed which it is desired to measure. On the basis of practical experience a maximum vibrating scale is made about seventeen millimetres wide with tongues of a width of about three millimetres.



CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

INCOME FROM COTTON MILLS.

BY ALTON D. ADAMS.

The cotton mill offers one of the largest loads that are available for electrical supply systems, and such loads are especially attractive beecause of their uniformity.

On the other hand, like most industrial power loads, the cotton mill ordinarily uses power during less than one-half of each twenty-four hours, not counting Sundays, even when in full operation. Cotton mills also require power in very large units in many instances, so that it is often a question whether anything can be saved by supply from a central steam-driven station.

To solve this question it is necessary to know the income that may be obtained from cotton-mill loads, and it is convenient to have this income reduced to dollars per horsepower of motors, per week, month or year.

In the North, comparatively little has thus far been done in the way of connecting cotton mills with electrical supply systems, though the construction of very large isolated electric plants for such mills is quite common. This situation appears to be due largely to the amount of power required by the ordinary cotton-mill plant in New York and New England, where the bulk of the northern mills are located, and to the fact that many of the most available waterpowers in this section were appropriated to cotton manufacture before the birth of electric power supply. Nevertheless, as the electrical supply systems grow larger and the more remote waterpowers are developed for transmission, cotton mills in various parts of the North are being connected to central stations.

Thus, the largest cotton-mill plant in Canada adopted electric drive with 3,412 horsepower of electric motors connected to the public supply system, some years ago. In a New England mill, electric motors of 746 aggregate horsepower began to operate with central-station power within the past decade, and in another mill of the same district the electrical supply system had a connected load of 817 horsepower in motors last year.

Cotton mills have connected much more readily with the electrical supply systems in the South, because the textile industry there has been developed mainly since the transmission of power on a large scale became common, and because there has been abundant unused waterpower. In fact, it is safe to say that but for the electric transmission of waterpower a large part of the present textile industry in the South would not have been created. Many of the more important waterpowers of the South are remote from the railways, which follow the ridges rather than the valleys, so that without electric transmission a mill must either use steam power or haul its product with teams, in many instances. Such circumstances as these helped to make it possible for a single electric transmission system in the South to connect with more than seventy cotton mills having an aggregate motor capacity above 30,000 horsepower, up to 1908.

It may be noted that the average horsepower at each of these southern mills was about 420, and this comparatively small power per mill makes it easier for the transmission system to secure the load, because the average cost of steam power to the mills must be high with these small units.

In the North, the regular running time of cotton mills is usually fifty-five to sixty hours per week, while in the South the figures are sixty to sixty-six hours per week. Where cotton mills are operated by a transmission system using waterpower the bearing of these hours of work is very important, as there must be sufficient storage capacity on the rivers to hold their night flow, if this is to be applied to the mill work.

Where the motors are well proportioned for cotton-mill work, it may be expected that the maximum load of a mill will approximate closely to its total motor capacity. Thus in a southern mill with 14,000 spindles and 800 looms the aggregate horsepower of driving motors was 445, and the largest observed load on this mill during twelve months was 320 kilowatts, or 426 electrical horsepower, amounting to 0.72 kilowatt per horsepower, of motors. On a day of eleven-and-one-fourth hours, when the total kilowatt-hours absorbed by these motors were 2,550, the observed power at four p. m. was 270 kilowatts, but this was a day of comparatively light load.

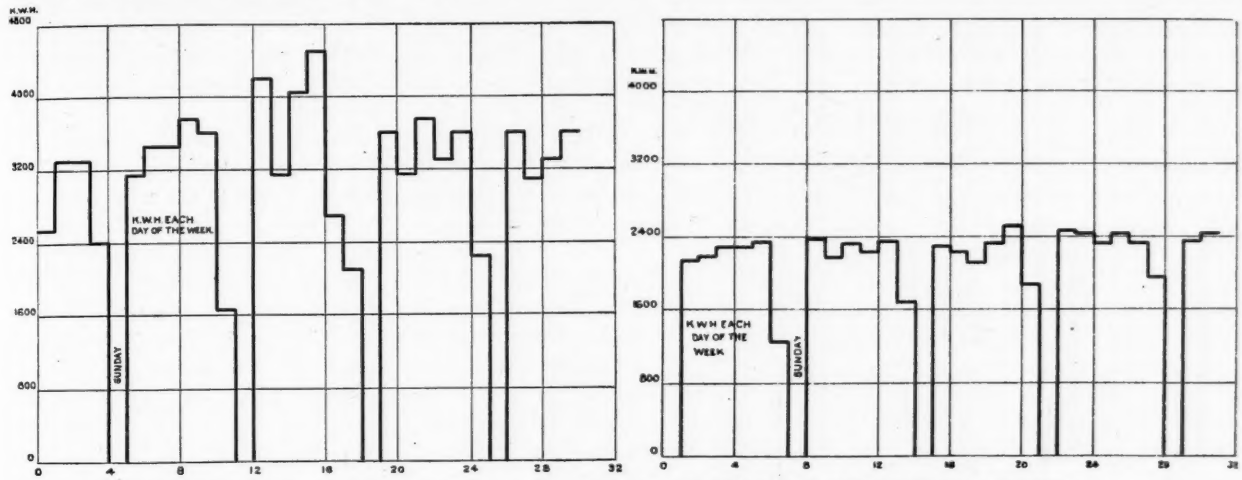
The uniform nature of cotton-mill loads is well illustrated by the two sets of curves presented herewith, each set showing the energy consumed by a mill during one month by ordinates for the number of kilowatt-hours used on each day of the month. In the mill with the larger consumption the figures are for the month of April, and in the other mill they are for the month of March. For the larger mill the regular time of operation is eleven-and-one-fourth hours per day except on Saturday, when the machinery stops at noon, and the time at the smaller mill approximates to these figures.

As the mills do not operate on Sunday, the curve for each is broken into parts corresponding to the several weeks and parts of weeks included in the month recorded. The consumption during three full weeks is shown for the greater mill, and the consumption in four full weeks for the lesser mill. In each set of curves the drop of consumption due to the short runs on Saturdays will be noted, and there is a break at each Sunday.

For the larger mill the three full weeks show consumption of 19,050, 20,700 and 19,650 kilowatt-hours, respectively. During the week when 20,700 kilowatt-hours were used there was one day with a consumption of 4,200 and one with a consumption of 4,500 kilowatt-hours, which last figures probably indicate some night work. On the basis of sixty-two hours per week, the average loads during these three weeks were 307, 333 and 316 kilowatts, respectively, but there was probably overtime in the week of largest consumption. Apart from the Saturdays and the two days that represent more than the usual hours of work, the consumption

ranged from 2,550 to 3,750 kilowatt-hours per twenty-four hours.

At the lesser mill the four weeks show 12,650, 13,210, 13,360, and 13,890 kilowatt-hours, respectively, amounting to average loads of 204, 211, 215, and 224 kilowatts, on the basis of sixty-two hours, operating time per week. Apart from Saturdays and Sundays, the least consumption per day at this mill was 2,110 and the greatest was 2,530 kilowatt-hours.



KILOWATT-HOUR LOAD CURVES FOR TWO COTTON MILLS FOR EACH DAY OF A MONTH.

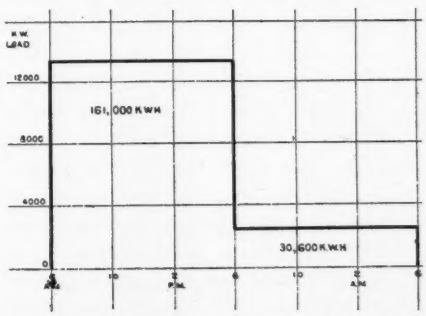
The character of cotton-mill loads shown above has a very marked effect on the load curve of an electrical transmission or supply system that is largely devoted to this class of work. Results in this respect are well illustrated by the twenty-four-hour load curve of a great hydroelectric system that is presented herewith. This load curve has been constructed by taking the average of the total kilowatt-hours delivered by the generating stations from 6 a. m. to 6 p. m. as the day load, and the average of the total kilowatt-hours from 6 p. m. to 6 a. m. as the night load.

From 6 a. m. to 6 p. m. the total output of the generating stations in this hydroelectric system was close to 161,000 kilowatt-hours, and from 6 p. m. to 6 a. m. it was about 30,600 kilowatt-hours, on an April day. The average load on the system during the twelve hours of day was thus more than five times as great as the average load during the twelve hours of night.

On the day for which this load curve is constructed, the system in question had some sixty-two cotton mills connected to its lines, besides a number of other factories and nearly a score of town-lighting plants. It was doubtless these lighting plants that absorbed most of the 30,600 kilowatt-hours from 6 p. m. to 6 a. m., as very few of the cotton or other mills operated at night.

In a certain cotton-mill plant in the North the rated capacity of motors last year was 817 horsepower, and the electric energy purchased for the operation of the plant by means of these motors during the year was 1,452 kilowatt-hours per horsepower of motor capacity. For this energy the rate paid was 1.8 cents per kilowatt-hour, so that the income to the central station that supplied it was $26.14 per horsepower of the rated motor capacity in the plant, during the year.

Another northern cotton mill operated 221.5 hours with motors of 1,365 rated horsepower, and consumed 148 kilowatt-hours per horsepower. On the basis of 3,000 operating hours per year, the motors in this mill would use 2,000 kilowatt-hours per horsepower, if the rate of consumption corresponded to that just stated. With 2,000 kilowatt-hours and a rate of one cent per kilowatt-hour, the annual income per rated horsepower of motors would be twenty dollars.



AVERAGE DAILY LOAD CURVE OF A SOUTHERN COTTON MILL.

In one month of regular operation during six days per week a southern cotton mill with 445 horsepower of motor capacity used 187 kilowatt-hours per horsepower of motors. For the same rate of consumption during twelve months the kilowatt-hours per motor horsepower would reach 2,240, and the income to the central station from this energy would be $19.92 per year, at 0.8 cent per kilowatt-hour, a rate which commonly obtains in southern mills.

The Canadian cotton mills that had 3,412 horsepower of motors connected to a central-station supply paid 0.57 cents per kilowatt-hour, and if the consumption was 2,240 kilowatt-hours per motor horsepower per year, the resulting income was $12.77 per horsepower of motors.

While the above rates are low, the duration and uniformity of the load makes it economical to operate such mills from large supply systems.

Grounding of Secondaries.

At the recent Atlantic City convention of the International Association of Municipal Electricians, the following resolution, introduced by C. S. Downs, city electrician of Altoona, Pa., was adopted:

Whereas, One of the purposes of the International Association of Municipal Electricians is the protection of the lives and property of the people whom we represent from electrical hazards, and

Whereas, Alarming destruction of life and property has resulted from high voltages on alternating current secondary systems by reason of the failure of the insulation between the primary and secondary circuits of such systems, and

Whereas, The existence of the said high voltages may be prevented by properly grounding the alternating current secondary systems. Now therefore, be it

Resolved, That the International Association of Municipal Electricians, deliberating as an international body, urges and demands the enactment of proper legislation requiring the grounding of all alternating current secondary systems, when by so doing, the voltage between the earth and any part of the said secondary system will not exceed 250 volts, and this body pledges the support and advocacy by its members of all legislative measures to the end.

Poor Municipal Wiring.[1]

Fire-alarm and police central-office wiring is far from being what is required by the National Electrical Code, suitable fireproof racks and cabinets being conspicuous by their absence, high-tension and sneak-current protectors not being provided, and often only bell wire being used to carry heavy-voltage circuits.

Battery stands and wiring thereto constitute a great source of danger when long circuits are to be provided for; also when storage batteries are used and stands are connected to lighting mains for charging.

When it is understood that the National Electrical Code contains a rule that requires all branch circuits connected to lighting circuits of 300 volts and less to be installed with rubber-covered, or slow-burning insulated wire, not less than No. 14 B. & S. and mounted on insulated supports that give at least half-inch separation between wire and surface wired over, to be at least two-and-one-half inches apart, and to be bushed through woodwork with approved tubes, it will be apparent that battery circuits, from charging board to battery stand at least, should comply with this rule.

Battery racks are sometimes ignored in providing protection against possible short-circuiting of battery wires between battery and switchboard. This is also a violation of the Code rule that requires proper fusing of all wires connected to a source of energy, whether dynamo or storage battery.

Current for charging purposes is often obtained from as high as 550-volt trolley circuits. This and most all lighting circuits being grounded on one side, always has a difference of potential between one side of circuit and ground equal to full voltage of line. This means heavy leaks to other circuits if not properly insulated, electrolysis of wires in damp places, and also a possible reversal of current in working circuits that may be run parallel.

Other requirements of the National Board of Fire Underwriters are: The proper distribution of circuits; not allowing more than twenty boxes to a circuit; avoiding placing both sides of the same circuit in one cable; fireproof buildings; records of tests and troubles; absolute non-interfering and successive movements in boxes; distances between boxes in congested business districts to be so arranged that there will be a box within 600 feet of all buildings.

[1] From an article by R. A. Smith of Norfolk, Va., in *Insurance Engineering*, October, 1909.

Maps are considered essential, and full records of lengths of circuits, tests of liquid of storage batteries and ample ventilation for battery rooms are advised.

These matters are of vital importance to fire-alarm and police superintendents. By observing them, they will be saved much embarrassment should a representative of the national or local board of fire underwriters pay them a visit and give them a write-up.

The proper observance and interpretation of other rules in code, relating to line work and lighting in general, are of vast importance to the city electrician. He will find constant study and application of the rules necessary, in order to keep abreast of the march of improvements, and necessary changes in rules.

There is much to be learned from attending the bi-annual meetings of the Underwriters' National Electric Association, held in New York. These meetings are open to all parties interested, and afford excellent means of finding out the true meaning of rules, as well as obtaining valuable information from inspectors from all parts of the country.

Electricity from Peat.

The department of Agriculture, Domains, and Forestry, in Germany, is engaged in opening up to culture the peat moor situated to the south of the Ems-Jade Canal, between Aurich and Wilhelmshaven. For this purpose a navigable canal is laid out through the moor, forming an extension of the Georg-Fehner Canal, and intended to terminate in the Ems-Jade Canal. Branch canals will eventually be dug for draining the moor.

The dredges used in forming the canals, as well as the presses intended for working the peat derived from the moor, were at first operated by steam engines. As, however, the heavy vibrations and considerable weight of these engines gave rise to earth slips, they were replaced by electric drive, a small power station with a 200-horsepower steam engine being erected in the middle of the moor on the Wittmund-Leer Highroad. The electric current generated at the station is used to feed the electric motors of the dredges and peat presses. Owing to the smooth working and small weight of these motors, any danger of earth-slips at the spot is now effectually eliminated.

The amounts of peat recovered in digging the canals are so important that they could not be marketed without serious prejudice to the minor moor owners. It was therefore decided to utilize this peat for the operation of a large electricity works intended to supply the whole of the neighboring district with electric light and power. The Siemens-Schuckert Company agreed to fit up the works on their own account. The construction of the new plant was begun in the autumn of 1908. Two steam turbines of 1,800 horsepower each with their respective boilers were provisionally installed, while a further set of 3,000 horsepower, which is in course of construction, will be taken into operation in the course of next year.

Part of the current generated by the dynamos, at a tension of 6,000 volts, is supplied direct to the neighboring working centers, for the operation of the peat presses, pumps, etc., while another part is raised in transformers to the tension of 20,000 volts, in order afterward to be supplied to more distant centers of consumption. The transmission lines are supported partly by wooden and partly by iron poles, the latter being used in solid ground and the former in soft ground. At present there are two large loop lines, one of which leads along the Ems-Jade Canal, eastward to Wilhelmshaven and back, via Zetel, to the central station, while the other runs alongside the same canal westward, beyond Aurich, touching Emden, Oldersum, Leer, and returning alongside the Georg-Fehner Canal to the central station. These lines are so substantial in construction as to allow anywhere of branch lines being installed, and thus the whole of Eastern Friesland may be supplied with current from this central station. Contracts for current supply have been concluded with the towns of Wilhelmshaven, Bant, Zetel, Leer, and the port of Emden, while negotiations are pending with a number of other communities. The construction of the plant is sufficiently advanced to allow the beginning of a regular service to be anticipated for next month.—*From The Times Engineering Supplement (London), October 27.*

The Smoke Problem in Illinois.

Considerable attention has been aroused in Chicago these last few days by the announcement of a new process for the coking of Illinois coal. The coke, used as a fuel, will go far, it is said, toward solving the smoke problem in the state, and the exploitation of the new industry is expected to give a new impetus to the coal-mining industry. Further developments are expected.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

STREET LIGHTING IN NEWARK, N. J.

BY H. THURSTON OWENS.

Newark, N. J., long known as a great manufacturing center adjacent to New York city, is making great strides to overcome any thought of its being merely a suburb of the latter. In point of population it stands sixteenth in the country with approximately 300,000 inhabitants, and, as far as public buildings are concerned, its Court House and City Hall rank among the finest in the country.

About a year ago the subject of street lighting was agitated, as the enclosed arcs and open-flame gas lamps were neither attractive nor satisfactory. As the city did not act, the merchants on Broad Street south of Market Street decided to change the lamps to the flame type and pay the additional expense. When the lamps were first turned on strings of incandescents were placed across the street, and quite a gala week ensued. During the past summer the merchants of Market Street had their street-lighting equipment changed and now the same thing has occurred on North Broad Street.

The results have gone further than producing a spectacular effect on these main streets, however, for the city authorities have taken up the matter of changing over the old open-flame gas lamps to the mantle type, and the work is well under way.

POSTS AND FIXTURES.

The posts formerly in use on Broad and Market streets were of wood with a more or less ornamental iron hanger at the top, as shown in Fig. 1, the lamp being seventeen feet above the pavement. When the first installation was made on South Broad Street thirty-five of the lamps were changed to Scott flaming arcs. Owing to the fact that the lamps were so low, there was considerable criticism passed upon the installation.

The merchants on Market Street decided to do better, so the poles were replaced with longer ones, as shown in Fig. 2, and fifty-eight Toerring flame arcs were hung twenty-five feet above the pavement.

North Broad Street, which begins at Market Street, had always been a better business thoroughfare than South Broad Street until the latter was lighted up, so the merchants of the former decided to outdo the efforts of their rivals and ordered fixtures which would as well be an ornament by day. These posts, as shown in Fig. 3, are the same height as those on Market Street, twenty-five feet; they were designed and built by the Elmer P. Morris Company, of New York city. The installation consists of thirty-three lamps.

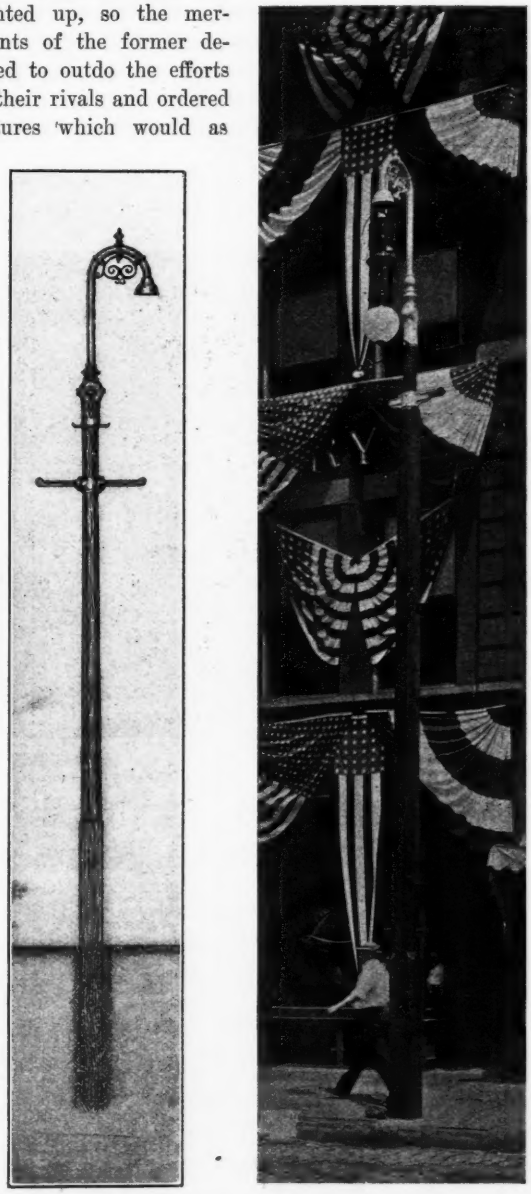


FIG. 1.—OLD POST USED IN NEWARK, N. J.

FIG. 2.—NEW POST USED TO REPLACE OLD ONE.

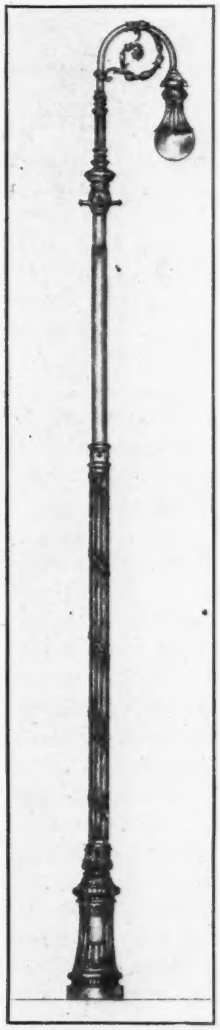


FIG. 3.—ORNAMENTAL POST USED IN NEWARK, N. J.

LAMPS.

As shown in Fig. 4, the Toerring flame arc lamp, which is used in both the latter installations, is somewhat of a novelty, inasmuch as it is constructed so that it can be connected directly across a 110-volt line, running two arcs in series within a single globe. Each arc is dependent on

its own regulating mechanism, which insures a perfect burning and regulation that would not be possible were the two arcs regulated by a common feeding device. The regulation of each arc for an alternating system is provided by a rotating aluminum disk actuated by a series and a shunt magnet, whereby a chain run on a pulley is unwound to feed the arc and rewound to lengthen the arc gap. The series coils, blow magnets, arcs and resistance are all in series, each shunt being connected directly across its own arc. The two sets of carbons are trimmed in a position inclining downward, the carbons being supported by chains from above, each of which in turn is regulated by its own aluminum-disk motor.

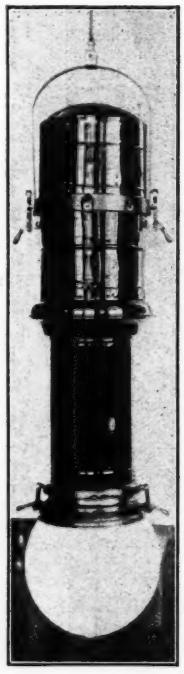


FIG. 4.—FLAME ARC USED IN NEWARK.

When the current is first thrown on, a current at a pressure of 110 volts actuates the shunts, causing a rapid rotation, tending to lower the two sets of carbons. Should one set get together before the other the shunts, of course, are short-circuited, and the downward rotation will stop on that side, the other pair of carbons still continuing down until contact is made at their tips. This closes the series circuit and throws current into the series coils, causing a rapid rotation, tending to pull the carbons upward and apart. As soon as these tips are pulled apart, however, a small shunt current immediately begins to flow, which, at a definite height of the carbons in the economizer, will cause a balance and the disk will become stationary. The arcs are now burning at their required voltage, and at a designated point in the economizer a definite distance from the blow-magnet pole tips, which stretch them and hold them rigidly on the carbon tips. As the carbon burns away, causing the arc gap to increase, the shunts predominate and slowly unwind the pulleys, lowering the carbons as they are consumed. The carbons by this method are always being fed a little and with a smooth, steady motion only as far as needed. Should an imperfection in the carbon cause an overfeed—that is, lowering the tips too low momentarily—the series magnet will immediately predominate and pull them back to the desired point once more.

The construction of the lamp is such that all moving parts are enclosed in a weather and dustproof cap, which never has to be removed by the trimmer.

The actual result of all this increase in street lighting at Newark has been to prove the truth of the saying that "Lights attract bugs and men."

New York Section, Illuminating Engineering Society.

The November meeting of the New York Section of the Illuminating Engineering Society was held on November 11 in the Engineering Societies Building. The following subjects were discussed:

"What Qualifications Should a Person Possess Before He Is Entitled to Assume the Title of Illuminating Engineer?" and "Should There Be a Division in Membership?"

The chairman, E. L. Elliott, called the meeting to order, and the secretary, A. J. Marshall, announced that the December meeting would be held in the Concert Hall of Madison Square Garden on the night of December 17, in connection with the Gas Show, which is to be held by the National Commercial Gas Association. At that time V. R. Lansingh will describe the model show room recently opened by the Consolidated Gas Company, of New York city, and H. Thurston Owens will deliver a lecture, illustrated with stereopticon views, on "Street Lighting Fixtures."

Although no set paper was to be delivered, there was a good attendance and many of those present discussed the questions presented. In opening the discussion Bassett Jones called attention to the fact that art and engineering have no common ground, and that persons of an artistic mind were rarely practical, and vice versa. The efficiency of illumination may not be judged by the flux of light upon a plane three feet from the floor or at any other height, as the real efficiency is the physiological effect upon the eye. Architects desire a certain lighting effect, and the work of the illuminating engineer is confined to the details of the lamps, reflectors, etc., which will produce that effect.

W. H. Gardner stated that a man should possess a thorough scientific knowledge of the laws of light and illumination and have a practical, responsible and extended experience before he should assume the title.

After further discussion between the two gentlemen mentioned regarding the relations between science and art, Dr. A. H. Elliott brought out the fact that engineering is the economical application of scientific laws, and inasmuch as that was true the question of art was not essential.

FIG. 5.—LIGHTING OF MARKET STREET, NEWARK, N. J., WITH FLAME ARCS AND TEMPORARY STREAMERS OF INCANDESCENTS.

After further discussion by T. I. Jones and N. Macbeth, the chairman closed the discussion and called attention to the fact that lighting overlaps, to a certain extent, the æsthetic side, and if this were not true architects would take more kindly to the subject. Engineering is applied science, and if illuminating engineers confine themselves to the engineering features alone there could be no clash with architects and decorators.

At the last annual meeting President W. H. Gartley nominated a committee to report on the division of membership, and E. L. Elliott, the chairman of that com-

mittee, stated that they would report at the annual meeting in January in favor of having Fellows elected by the council upon the recommendation of a committee on fellowship. This subject was very warmly discussed by Doctor Elliott and Messrs. Marshall, Bassett Jones, T. I. Jones, C. W. Jones, Macbeth, Gardner, Forchette and Owens. It was brought out that practically all societies have classes of membership except this one, but many argued that the time was not ripe to bring this change about, and upon a motion by Mr. Marshall it was voted by those present that any action taken at the present time would be premature.

Chicago Section Illuminating Engineering Society.

The Chicago Section of the Illuminating Engineering Society held its first meeting this season in the Chicago room of the Great Northern Hotel at noon on November 11. The custom of holding the meeting directly after a luncheon will probably be carried out throughout the coming year. When the meeting was opened by Chairman Albert Scheible the topic announced for discussion was the paper by L. B. Marks on "Factory Lighting" that was read before the recent convention of the society. Mr. Scheible presented this paper in abstract form pointing out clearly and with great fidelity the most important points that had been made by its author.

The discussion was opened by J. E. Moore, of the Western Electric Company. This company is now carrying out a scheme of general illumination at its new Hawthorne shops which is planned to give sufficient general illumination for all average operations. This lighting is supplemented by individual lighting in certain cases where a more concentrated light is needed for special work. In the assembly department forty-watt tungsten lamps with prismatic reflectors are spaced about seven-and-one-half feet apart for general illumination. An average of about 2.8 foot-candles is found at a working plane thirty inches from the floor. The energy consumption averages about 0.68 watt per square foot. For the comparatively few individual lights needed sixteen-candlepower lamps with metal reflectors are used. In the coil-winding department where much small work is done four-light tungsten clusters at nineteen-and-one-half to twenty-nine feet centers and nine-and-one-half feet from the floor are used. The illumination on the working plane is found to vary from 2.1 to 1.3 foot-candles from points directly below to points midway between the lamps. This is found to be ample for practically all the general operations, although there are a few individual lights installed for special work. A similar installation equipped with Gem lamps instead of tungsten was found to give 2.2 to 1.0 foot-candles.

L. G. Shepard, of the Federal Electric Company, said that in that company's shop some very good results are obtained with sixty-watt tungsten lamps equipped with twenty-inch steel reflectors. These are installed in fourteen-foot bays and give good general illumination when aided by a few special lamps for close work.

Mr. Hubbard, of the Adams-Bagnall Company, said that his company now recommended very strongly the use of flame arc lamps for foundries and other shops. He described the regenerative flame lamp in some detail. Where traveling cranes are used the ordinary arc cannot be hung properly, but flaming arcs may be hung above the crane from twenty feet up to seventy-eight feet above the floor and approximately seventy-five feet apart with a resulting illumination of about two foot-candles.

George C. Keech, of the Cooper-Hewitt Lamp Company, said that Mr. Marks' paper is certainly a body-blow to localized lighting. He emphasized the great trouble from promiscuously hanging drop-cords and the severe eye trouble resulting from great contrast from bright to dark surfaces; also the trouble from oil, dust and finger-marks on the lamps. He believes that the placing of high candlepower lamps near the walls so as to have the light enter the room from the same general direction as during the day should produce nearly ideal results.

J. R. Cravath stated that we are new trying to get away from localized illumination and certainly are using general lighting much more extensively than heretofore. However, in some places it is physically impossible to rely exclusively upon general lighting. Where individual lighting is necessary it should be installed with better cords, shade holders, cord adjusters, shaded lamps, etc., so as to make the localized lighting installation as rugged and as effective from an illuminating engineering standpoint as possible.

The subject was also briefly discussed by Mr. Hoffman, of the Pullman Company, who spoke of some tests now being made for the proper lighting of the large car shops which are located at Pullman, Chicago.

Lamps for Residence Illumination.

To the Editors:

As I have noted from time to time a willingness on your part to devote space to the advancement of illuminating engineering, I therefore desire to add a contribution to the discussion to the paper on "Lamps for Residence Illumination," by Prof. Arthur Curtis Scott, as abstracted in your publication of August 7, 1909.

In the center of the first column, on page 246, where he advises the use of wall switches rather than socket switches, you neglected to give the reasons advanced:

"It is well known that there is a possibility of the high-tension current finding its way into a low-tension circuit to such an extent as to cause serious or fatal shock to a person, without any possible indication of such trouble being given to the operator at the power plant. The method commonly followed by people unfamiliar with electrical work, of grasping a socket of a lamp suspended by a flexible cord, with one hand, and turning the socket switch with the other, is a much more dangerous one than the opening or closing of a wall switch, where only one hand would be used."

In the second column the statements are made:

(1) Very efficient sources of light are likely to be of high candlepower and must be placed comparatively far apart, and the efficiency of distribution is decreased.

(2) Light produced at high luminous intensity is more rapidly absorbed by the atmosphere, and, therefore, less proportionately reaches the object to be illuminated.

This is certainly erroneous, and resembles in many respects the popular misconception regarding the application of the inverse-square law. The small tungsten lamps are quite as efficient as the larger ones and, in addition, they show much better life; in incandescent gas lighting with low pressure the small two-and-one-half-inch upright mantle has shown an efficiency considerably above the larger lamps, both upright and inverted. At any rate, whether a source be one of high or low candlepower, the actual intensity has no bearing on the "efficiency of distribution."

That "light produced at high luminous intensity is more rapidly absorbed by the atmosphere" should be a factor in "lamps

for residence illumination" is certainly a point which illuminating engineers have grossly overlooked.

The tables given are those with which your readers should be quite familiar, that giving "the desirable amount of illumination for various classes of service" having been published by several accessory and lamp manufacturers. Little of this data has been based on actual measurements of existing installations. The table of coefficients of reflection from various colored surfaces is from Bell's "Art of Illumination," page 52, published in 1902; and that giving the relative intensities of light sources in candlepower per square inch, from "Art of Illumination," page 9, supplemented by Woodwell, "Illuminating Engineering Society Transactions," 1906, page 256, and bulletins issued by electric incandescent-lamp manufacturers.

The light-distribution curves of Welsbach lamps, also those showing the candlepower variation with variation in pressure, of which Professor Scott says, "This curve (Fig. 7, page 20) is drawn as the average of a number of tests, and evidences the fact that the candlepower increases rapidly with increase in pressure," were copied from "Practical Illumination" (Cravath and Lansingh, 1907, pages 76, 77 and 78), and were given by the authors to show the performance of one upright burner on New York city gas under various ordinary pressures when the burner was adjusted at each reading point for maximum incandescence.

A close reading of Professor Scott's paper does not show any reference to upright incandescent burners, excepting on two lines on page 6, where the distribution curve of an upright Welsbach lamp is compared to that of a tungsten lamp. We are therefore to assume that the pressure and candlepower characteristics of Welsbach Reflex lamps, with the gas supplied in Austin, give results exactly similar to those shown by one upright burner tested on New York city gas in 1906, on pressures from one to 3.5 inches, while the only pressures shown in Professor Scott's paper, page 25, run from 3.5 to 4.3 inches.

In "Data on Gas Lamps," page 35, with five Reflex Welsbach lamps on test, at 300 hours a "hole in mantle No. 3" is reported, and at 600 hours "mantle No. 3 burned out." The gas lamp, unfortunately for results in tests of this kind, does not open the circuit nor turn off the gas when the mantle "burns out," and consequently, for the purposes of a just and fair average, Messrs. Conrad and McCullough, who were directly in charge of the test, permitted the gas to continue to register for the "burned-out" mantle for the 400 hours remaining up to the 1,000-hour point. This latter is, of course, a bald assumption on my part, as it is possible that the other four lamps may have increased their consumption to just equal that taken by the five at the 600-hour point and continued the necessary average to the 1,000-hour point.

The mantles on this test showed erratic action, mantle No. 3 showing an increase of over sixty per cent in candlepower for the 100 hours' burning after the "hole" developed and but three per cent less for the next 100 hours, finally burning out at 600 hours with a Fourth-of-July rocket finish, the candlepower being forty per cent higher than at the 300-hour point.

Mantle No. 2 stood at 1,000 hours with a rating thirty-three-and-one-third per cent higher than at the 300-hour point and thirty-eight per cent higher than at the 700-hour point, and so on.

Professor Scott says the results showing costs per kilo-candlepower-hour for 1,000 hours' operation with electricity at ten cents per kilowatt-hour and gas at $1.70 (net) per 1,000 cubic feet "may be tabulated as follows," which really does not add particularly to their value. Even your typographical error could hardly take from the value of the conclusions reached. With the Nernst 0.6-ampere lamp on the "horizontal candlepower basis" of rating, the cost as given is over twice that of the rating "on basis of mean candlepower between vertical and horizontal values in lower hemisphere"—26.4 cents per 1,000 candlepower-hours as against 12.4 cents.

The table as given when reduced to familiar terms, is as follows:

Type of Lamp.	C.P. per cu. ft. per hr.
30-C.P. Reflex Welsbach[1] lamp (horizontal C.P. basis)	6.87
80-C.P. Reflex Welsbach lamp (on basis of mean C.P. between vertical and horizontal values in lower hemisphere)	5.85

	Watts per C.P.
60-watt tungsten lamp	1.489
40-watt tantalum lamp	2.642
50-watt "Gem" lamp	3.287
110-volt, 16-C.P. carbon-filament lamp	4.255
Nernst 0.6-amp. (horizontal C.P. basis)	2.644
Nernst 0.6-amp. (on basis of mean C.P. between vertical and horizontal values in lower hemiphere)	1.24

Considering the paper as a whole I fail to see wherein the tables and deductions can be other than misleading.

NORMAN MACBETH.

Philadelphia, Pa.

[1] The only Welsbach reflex lamp on the market has a nominal rating of sixty mean spherical candlepower or 750 lumens on a consumption of 3.3 cubic feet of gas per hour at 2.5-inch pressure.

New Electric Sign Rules.

The new rules promulgated at Dallas, Texas, regulating electric signs meet with the general approval of business men except the clause providing that any sign extending over the sidewalk or alley or public way to a length of more than eighteen inches from the property line shall have at least eight candlepower of lights to every square foot of surface and shall be maintained in full illumination until midnight every night. The objection to the clause is the expense. The commissioner's aim is merely to obtain safety from improper signs overhead and provide adequate street lighting.

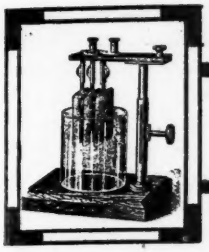
The Illuminating Engineering Society of Great Britain.

The opening meeting of the British Illuminating Engineering Society was scheduled to take place on Thursday, November 18, at 8 p. m., at the premises of the Royal Society of Arts, Adelphi, London. A brief report of the progress of the society was to be presented by the honorary secretary, Leon Gaster, and the inaugural address was to be delivered by Prof. Silvanus P. Thompson, the first president of the society.

Central Park to be Properly Lighted.

Central and Prospect parks in New York city are to be more adequately lighted at night. The Board of Park Commissioners has not only decided on this action, but the conduit for laying the electric light wires have already been partly installed, and in Central Park many of the posts that will hold the new lights have been put up. While there are now 400 gasoline lights in Central Park there will soon be 1,477 electric lights.

The business men along Blue Island Avenue, from Sixteenth to Twenty-second streets, in Chicago, have decided to install special tungsten street lights on ornamental posts twenty-five feet apart along the curb line.



ELECTRO-CHEMISTRY and METALLURGY

LAWS OF ELECTRODE LOSSES IN ELECTRIC FURNACES.[1]—I.

BY CARL HERING.

At the last annual meeting of this society the writer showed how it is possible to obtain in practice the combined effects of perfect heat insulation and good electrical conductivity, two antagonistic qualities which it was heretofore generally supposed could not both exist in the same material.

The method is as follows: Let *e* (Fig. 1) be the electrode. If now it be so

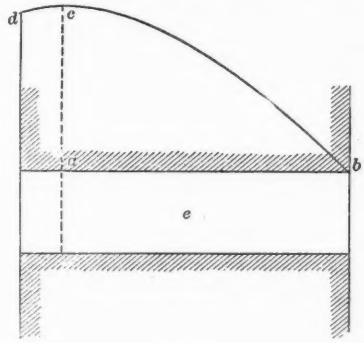


FIG. 1.

proportioned that the electric or C^2R loss heats the furnace end to a slightly higher temperature than that of the furnace, there will be a flow of heat from that end into the furnace. Let the section *a* very near the hot end be that at which the temperature is greatest; then the heat gradients *cb* and *cd* will evidently fall in both directions. This means that some heat flows from that hot section into the furnace; and as heat cannot flow in two opposite directions at the same time, it follows that no furnace heat will flow out of the furnace through such an electrode, which therefore becomes in effect a perfect heat insulator, more perfect even than the walls of the furnace, while at the same time it remains a good electrical conductor. In practice it is not necessary to make this temperature higher than that of the furnace, as it need merely not be lower, and the section *a* is best made to be the extreme end of the electrode. Hence the results will be accomplished if the C^2R loss heats the end of the electrode to the furnace temperature. It will be shown that these are the conditions for obtaining the minimum loss.

There are two kinds of losses which must be considered in electrodes: First, the loss due to the conduction of heat by the electrode from the material or gases in the furnace to the outside, which may be termed the heat-conduction loss, or simply the thermic loss; and, second, the loss due to the eelctrical resistance of the electrode, which may be termed the electrical loss, or th C^2R loss. Both losses originate electrically, and are therefore of equal commercial value in cents per kilowatt-hour. For a given length, if the cross-section increases, the heat loss increases, while the electrical loss diminishes; while for a given cross-section the reverse is the case when the length is increased. Moreover, the thermal and the electrical conductivities of the particular material enter into the determination of these losses; and the total loss may be partly thermal and partly electrical, or entirely electrical or thermal, or even only a part of the C^2R energy. As these physical properties of the electrode material are an important factor, a comparison between two materials, like graphite and carbon, is evidently not a fair one unless each of the electrodes has its best proportions. The problem of finding the best conditions is therefore not a simple one.

The author has thus found the following relations to exist, which, as they are absolute, may be termed the laws of electrode losses.

Laws of Electrode Losses.

a. The combined loss through the cold end of an electrode is equivalent to the sum of the loss by heat conduction alone (when there is no current) and half the C^2R loss.

b. This combined loss will be least when the loss by heat conduction alone is made equal to half the C^2R loss; the total loss will then be equal to the C^2R loss and no heat will be conducted from the interior of the furnace.

c. This minimum loss is dependent only on the material, current and temperature, but not on the absolute dimensions; it merely fixes the relation of the cross-section to the length, but leaves a choice of either; hence

d. For economy of electrode material the length should be made as short as practical considerations permit.

e. For each material there is a definite minimum loss of electrode voltage which depends only on the temperature and is independent of the dimensions or the normal current for which the furnace is designed; hence

f. The best possible electrode efficiency for any material may be determined from the total voltage of the furnace and this minimum voltage due to the material and the temperature, and is independent of the dimensions.

g. The heat gradient of the combined flow is equal to the sum of the heat gradients of the individual flows.

These laws are based on the following fundamental assumptions, any departures from which must be treated as correction factors: (1) That the electrodes have a uniform cross-section throughout their whole length. (2) That no heat leaves the electrode to the furnace walls or enters it from them; this is approximately true in most cases, because the heat gradients are approximately the same in both, and

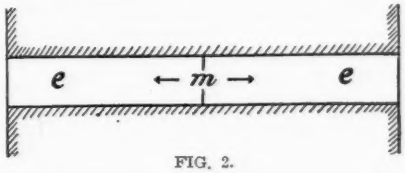


FIG. 2.

there is contact resistance between them which may be quite great. (3) That the temperature variation of the heat conductivity is approximately a straight line proportion.

Neither of the two latter conditions seem to be accurately true, but the differences are probably small in comparison with the best possible degree of accuracy with which the most desirable proportions of furnaces can be predetermined or realized in practice. Hence great accuracy is not essential. The matter of importance for us to know is in what direction to go to reduce the losses, and approximately what the minimum possible loss is, so that we can approach it as closely as practicable and do not waste efforts in trying to realize something which is impossible.

The conditions of minimum loss for a given normal current are illustrated in the following simple cases: Let *ee* (Fig. 2) be an electrode surrounded by a perfect heat insulator except at its ends,

[1] Abstract of a paper presented at the sixteenth annual meeting of the American Electrochemical Society at New York, October 30, 1909.

which are kept cool, say, with a water jacket. Let a relatively large current be passed through it. This will heat it to a high temperature at the middle m. When the stable state is reached, all the C^2R heat will flow out at the two ends, and none will flow across the section m.

If now this embedded electrode be imagined to be cut into two parts at m, and if these two parts are made the two end walls of a furnace with these conductors as its electrodes, as in Fig. 3, the temperature of the interior of the furnace

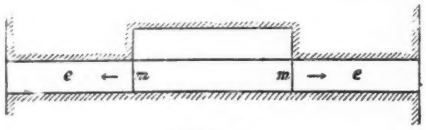


FIG. 3.

being the same as that at m was in Fig. 2, it is evident that the heat flow will not be altered while the same normal current is flowing, and that therefore there will be no loss of heat from the interior of the furnace through the electrodes. This is the condition of minimum electrode loss.

The writer has determined the following equation for the combined flow:

Let X be the total energy expressed in watts, which flows out at the cold end of a conductor; C the current in amperes; T the difference in temperature in centigrade degrees between the hot and cold ends; S the cross-section in square inches; L the length in inches; k the average heat conductivity (or specific heat conductance) in gramme calories per second per degree centigrade for one inch length and one square inch section for the given range of temperature; r the average electrical resistivity (or specific resistance) in ohms for one inch length and one square inch section for the given range of temperature; and let one calorie per second equal 4.186 watts.

Then

$$X = 4.186\,kT.\ S/L + C^2r/2.\ L/S \ldots (1)$$

It will at once be seen from this that the first term represents the heat (in watts) that would flow by heat conduction alone, that is, when no current is flowing (the constant 4.186 is merely the figure which reduces calories to watts). It will also be seen that the second term represents the C^2R loss and is equal to half of it. Hence this general law may be stated in words as follows: The total flow of energy out of the cold end is equivalent to the sum of that which would flow by heat conduction alone, and half of that due to the electrical resistance.

[To be continued.]

ELECTROLYTIC BLEACHING.

BY J. B. C. KERSHAW.

The comparative efficiencies of bleaching-powder solutions and electrolytic bleach liquor, for bleaching cellulose, have long been in dispute, and there are many chemists who still believe that the greater efficiency claimed for the product of the electric cell is chiefly due to the use of incorrect or unreliable methods of analysis and comparison. That the atom or molecule of chlorine liberated from a solution of bleaching powder should possess less bleaching (*i. e.*, oxidizing) effect than the atom or molecule of chlorine liberated from a solution of hypochlorite, prepared in the electrolytic cell, seems to them incredible.

The constitution of the two solutions, they urge, is chemically alike, and the only difference is in the base with which the hypochlorite acid is combined—calcium in the one case and sodium or magnesium in the other. The supporters of electrolytic bleaching methods contend against this view, that the combination between the chlorine and the base is looser and more easily broken down in the electrolytic solution, which is, in fact, partially ionized when ready for use.

The most recent contribution to the study of this subject is a paper by Doctor Fraas, published recently in two German periodicals. In opening the paper the author refers to the earlier investigations of German chemists, and states that Doctors Kind and Weindel had already by their researches proved the superior efficiency of electrolytic bleach liquor for bleaching cotton, but had not dealt especially with the settlement of the same question as regards cellulose. The great delay in deciding this question has been due to the difficulty that exists in obtaining reliable standards of comparison in bleaching work, and also in obtaining exactly similar conditions for the trials.

This difficulty has been much greater in the bleaching of cellulose than in that of cotton goods, and for this reason most of the attempts have been made on a laboratory scale of operations. These give figures of value for comparative purposes, but not for estimating the absolute amount required in bleaching on a large scale, since here the mass of materials dealt with has important bearing upon the results.

The following points were investigated by the author: (1) Which of the two bleaching agents gives the better color when using similar amounts of chlorine. (2) What saving in chlorine or bleaching agent is possible, when obtaining equal bleaching effects. (3) What influence have variations in the acidity of the souring liquors upon the results. (4) What influence has an excess of bleaching agent upon the results.

A total of forty-nine experiments were made during the investigations, and the results of these are set forth in four tables to be found in the original paper.

The results are summarized by the author as follows: (1) Using equal amounts of chlorine, and working under similar conditions, the electrolytic bleaching liquor gives the better bleaching effect. (2) If the bleaching effect be stopped at the same degree of whiteness, the use of electrolytic liquor enables a saving of five per cent of chlorine to be made, when working with alkaline solutions. (3) The presence of an excess of bleaching liquor does not alter these comparative results. (4) Increase of alkalinity diminishes the rate of bleaching, but increases the final effectiveness of the bleach, in the case of both electrolytic and bleaching-powder solutions.

The author finally remarks that although the economy due to the use of electrolytic bleaching solutions may be small, yet the results prove that in the bleaching sulphite wood-pulp and cellulost, the electrolytic liquor gives the better bleaching effect.

As practical commentary upon this investigation, it may be stated that the Haas and Oettel form of electrolytic cell for the preparation of bleaching solutions is finding extended use. It is stated that over 600 of these electrolyzers are in use today, in the textile industries, in laundries, and in public institutions.

Tension of Electrolytic Metallic Films.

In a paper by Gerald Stoney, read before the Royal Society of London (Eng.) last May, the author showed that metals are electrolytically deposited under tension, and hence tend to strain the cathode on which they are deposited. Steel rules on which he electrolytically deposited a thin coating of nickel were bent considerably by this tension, the author calculating from his observed data that the stress amounted to from about eight to twenty tons per square inch for thicknesses of films ranging from 0.046 to 0.056 of a millimetre. On heating to redness the annealing caused an appreciable straightening of the rules.

Gold Recovery by Electrolytic Amalgamation.[1]

The electrochemical system of amalgamation is designed to extract from the sands or pulp, all gold values not encased. It is entirely a new system of amalgamation, designed to do the work of the ordinary mill plate. This includes the treatment of slimes, and the simultaneous extraction of values which cannot be saved by the usual mill practice. These latter would otherwise require cyanide treatment, and the new process does all this in one single, inexpensive and continuous operation, requiring practically no more outlay for installation and maintenance than the usual mill plate. The system also furnishes a method by which the black sands, desert deposits and many low-grade propositions can all be profitably worked. The broad claim made for the electrolytic system is that it will save all values not encased.

It will be observed that the one point most emphasized by the above statement, which is paraphrased from a recent expert article on the subject, is that the electrolytic system will save all values not encased. For the cyanide process, no such claim is made, as there are many minerals found in ores that prevent the use of cyanide, either by rendering the operation too costly, or by causing a low percentage of extraction, even when the gold has been set free by a proper pulverization.

What is stated to be the first carefully constructed electrolytic amalgamating sluice, is one now in use in the laboratory of the Noble Metals Recovery Company, at San Francisco, for demonstration purposes. It has a capacity of about six tons of ore per twenty-four hours, and is the smallest apparatus made for general work, a larger one of the capacity of 100 tons, being the standard size. But there has been introduced, for laboratory work, a very much smaller apparatus, having a range capacity of from one-fifth assay-ton, to ten assay-tons per unit of time.

This smaller apparatus is of a different form and construction, though operating under the same electrolytic conditions, and is used for assaying and other determinations. It has been found perfectly reliable, and has been very extensively used, not only to give the values of various ores and sands, but also to elucidate the conditions necessary to a perfect obtaining of values from these materials.

In one line of research by this means, the matter of fineness, or necessary pulverization has been taken up. It has been found that in beach sands and placers generally, no further pulverization is necessary, nature having attended to this important part of the work. In ores, however, a considerable pulverization is necessary to obtain perfect results, the range for this being from thirty up to 150 mesh. And not only does this apply to pyritic ores, but to those generally considered "free milling."

There appears to be no general law governing the degree of fineness of mechanical reduction necessary to a full obtaining of values, but that each ore is a law unto itself, and that this applies not only to recovery by electrolytic amalgamation, but equally so to extraction by cyanide.

The profound difference that lies between the two methods may be seen at a glance. In the one case, the fine comminution produces final results with added recovery and no additional cost; but in the other, it leads to a variety of further costly manipulations, each of which is a source of loss of gold, and still further lengthens out the time consumed in the operation of extraction.

Taking into comparison a unit capacity of 100 tons of ore per day; each ton passing through the cyanide process requires continuous attention and manipulation, for a period of from three to six days, according to the manner of working and the fineness of mechanical reduction. In the electrolytic system each ton of ore, of whatever fineness, is handled and finally disposed of, in less than fifteen minutes.

The electrolytic amalgamation system aims always at a full recovery of values, and it is considered bad work when even the slightest particle of gold escapes. The potent forces employed in the work and the simplicity with which these may be adjusted, makes this immediate extraction possible; and when the system is properly installed, and operated by those properly instructed, this result may be relied upon.

The limitations to the use of cyanide in no degree extend to electrolytic amalgamation; for, as far as is yet known, there is no element that enters into gold-bearing ores which hinders the efficiency of the method.

Ores of an alkaline reaction and of an acid character, have been both tested, with equally good results, and as well, those so deterrent to the ordinary cyanide treatment.

As before stated, the system is applicable to the universal field of gold recovery, from the meager tahona of the prospector, which it will double in capacity, to the mill of 1,000 stamps, to which it will afford a higher recovery and a lessened expense.

It has a future also on the million acres of black sands of the coast, and at the hydraulic mine and on the gold dredge.

[1] Abstract of an article by J. H. Jory in *The Mining World* for October 2, 1909.

A New Electrolytic Process.

At a recent meeting in London, Eng., of the Rhodesia Broken Hill Development Company, says the *Daily Telegraph,* of Sheffield, Eng., the question of ore treatment was discussed, and it was reported that preliminary trials, recently made at Sheffield, of an electrolytic process had been considered by the company's consulting engineers as sufficiently encouraging to warrant the erection of a plant with a view to treating a considerable quantity of ore on a working scale. Orders have been given for a complete plant, and this would be erected on a site which had been secured in London. About 180 tons of ore have been secured for the purpose of the experiment, and should the results be satisfactory it was proposed to form a process company to acquire the patent rights for the whole of Rhodesia.

Electricity in Mines.

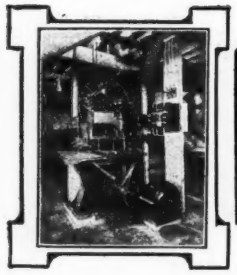
The British Home Office has appointed a departmental committee to inquire into the working of the existing rules for the use of electricity in mines in Great Britain and to consider alterations which may appear desirable. The committee consists of R. A. S. Redmayne, his majesty's chief inspector of mines (chairman), Robert Nelson, his majesty's electrical inspector of mines (secretary), and Charles H. Merz.

Electric Steel Plant for Russia.

A British correspondent states that the Slatons Works, in the Ural district in Russia and forming part of the royal estate, have made arrangements with a German company to use its patent induction steel furnace. The electric plant will be furnished by the Siemens-Halske Company.

A New Electrode Factory for Scotland.

A London correspondent writes that an electrode factory has recently been constructed at Kinlochleven, Scot., by the British Aluminum Company.



Industrial Power

CAUSES OF BREAKDOWNS IN ELECTRICAL MACHINERY.—II.

A BRITISH INSURANCE COMPANY'S REPORT.

The effect of corrosion from sulphur fumes and the importance of proper housing were instanced in the case of a three-phase, alternating-current, semi-enclosed motor taking current at 440 volts and developing fifteen horsepower at 800 revolutions a minute. The motor was located at the top of a tower in a chamber which was often full of dust and steam arising from the slacking of hot ashes with water. The cause of the breakdown in this case was that the insulation of the stator windings had become rotted by sulphurous steam and impregnated with dust and dirt, so that they became short-circuited. The fuse melted and four of the stator coils were burned, the top and bottom in one slot and the top in the two adjacent slots.

A short-circuit caused by an accumulation of dust under the string binders of a four-pole, enclosed, shunt-wound, direct-current motor was responsible for the breakdown in another case. This motor drove two drilling machines by gearing and was protected by a copper-wire fuse designed to melt at forty-eight amperes. The short-circuit occurred while the motor was driving the machines idle, and was caused partly by abrasion of the insulation, due to the jarring of the gearing and partly by accumulation of dust under a broad binder of string around the end winding. When the armature coils were lifted for repair the installation was found to be so deteriorated that the armature had to be entirely rewound.

Imperfect insulation of the armature troughs caused the breakdown of a four-pole, semi-enclosed, shunt-wound, direct-current motor taking current at 420 volts and giving two horsepower at 650 revolutions a minute. The armature conductors were laid in slots and insulated from the core plates by presspahn, varnished calico, and strips of mica. The armature winding was earthed, one of the coils was fused and the insulation burnt. As a consequence the coils had to be entirely rewound. The trouble was due to the fact that the insulated troughs in which the coils were carried reached only half way up the sides of the slots, so that every turn of each of the top coils had to rely on its own cotton covering to insulate it from the core.

Lack of proper precaution in turning up the commutator in the lathe caused three of the commutator segments of a shunt-wound motor to become short-circuited by copper dust and partly fused, the insulation being burnt off from three of the armature coils. The cause of the breakdown in this case was due to the fact that the owners of the machine, who had been turning the commutator in one of their own lathes, had neglected to clean out the copper dust from the mica between the bars or to see that there was no bridging from bar to bar before replacing the armature in its bearings.

An overworked driving rope was the cause of the downfall of a six-pole, direct-current dynamo giving 340 amperes at 220 volts when running at 650 revolutions a minute. The armature shaft was carried in three bearings and was driven by eight ropes with the driving spans uppermost. One of the ropes broke while the machine was running, a loose end fouled the outer bearing of the armature shaft, tore the machine bodily from the foundation rails, and caused a general smash-up. The design of the rope drive was greatly at fault, and the ropes were accordingly much overworked.

In discussing the case of a breakdown of a four-pole, shunt-wound, twenty-seven-horsepower, direct-current motor, due to a defective brush-holder, Mr. Longridge mentioned that his company has had the least trouble, perhaps, with brush-holders consisting of a plain box holding a rectangular block of carbon with a flexible conductor attached, and a spring to keep the carbon up to the commutator surface.

A defective armature nut was the cause of the failure in the case of a four-pole, semi-enclosed, shunt-wound, direct-current motor used for driving a pump in a coalpit by gearing. On examination several of the conductors were found to be broken just behind the commutator spokes, and the commutator and armature cores were loose on the shaft. This was due to the slacking back of the nut which held the core plates, so that all the plates were loose. Forty-six out of a total of eighty-eight were broken and the rest were considerably damaged. The nut had not been fastened by a lock nut or taper pin. The report makes the recommendation that core plates can be held endways more safely by a ring sunk in a circumferential groove on the spindle than by a nut, but that the bottoms of the grooves for such rings should be rounded instead of square-cornered.

Two cases, taken at random, from a large number, were instanced to show the danger of sharp corners in commutator cores and defective shaft connections. Mr. Longridge says in this connection: "Surely common sense should suggest that the edges of end plates and winding drums over which thinly covered conductors pass should be well rounded, and that the conductors should be still further protected by strong presspahn or other insulating material. It is not possible to entirely prevent relative movement between the conductors and the core of winding drum, and it is certain that any movement, however slight, will enable a sharp metal edge to cut through the thin covering of an armature conductor. This relative motion is also responsible for another large class of accidents, the fracture of armature conductors at their junctions with the commutator arms. The usual methods of preventing the rotation of armature spiders and commutator quills, and still more of armature core plates threaded upon the shafts, by feathers, projecting screw heads, and set-screws are not effective, either because the bearing surfaces are insufficient, or because the fitting is not good enough. The best plan when the diameter permits undoubtedly is to build both armature and commutator upon the same casting."

An overload on a punching-machine motor gave rise to an increase in temperature which melted the solder out of

most of the joints of the rotor commutators. The melting solder ran to the two short-circuiting rings and was thrown on to the end windings of the stator and into the air gap, damaging the insulation. The breakdown was ascribed by the owners of the motor to overrating by the makers, but it was shown that it was really due to negligence in watching the ammeter and to inability in properly fixing a limit to the resistance of the machine tool driven by this motor.

The last case recorded was the curious breakdown of a semi-enclosed, three-phase, alternating-current motor with wound rotor, slip rings, and carbon brushes. The motor was belt-coupled to an ash elevator and controlled by a three-pole switch in the stator circuit and a regulating resistance starting switch in the rotor circuit. The electrician in charge reported that the motor refused to start even with the belt off, and that one of the carbon brushes got red hot. On examination it was found that a short-circuit was established between two conductors belonging to different windings, due apparently to an accumulation of dirt between the conductors and under the binders on the end connections at the driving end of the rotor. The rotor had also been in contact with the stator, the binders were taken off, the conductors lifted, and the dirt cleared out. On reassembling, the machine started without difficulty. It was supposed that the breakdown was due to springing of the shaft by unequal magnetic pull, caused by short-circuiting.

The general conclusions of Mr. Longridge were as follows: "The general impressions left upon the minds of those in charge of the electrical department are that a very large majority of the breakdowns are due to the deteriorating effect of oil, dust, and damp on the materials used for insulating. Of these, oil is the most injurious and most difficult to deal with. Better arrangements are needed to prevent oil throwing. If oil once gets out of a bearing it creeps along the shaft to the back of the commutator and on to the end windings, also on to the commutator insulation and brush gear, and mixing with copper, carbon, or other dust forms short-circuits, giving rise to carbonization and 'burning out.' The next most fruitful cause of damage is probably imperfect fitting, keying, and locking of spiders and core plate, commutator brushes, and even pole-pieces, leading to abrasion of insulation, and 'earthing.' Careless winding and fitting of magnet coils is also sufficiently common to be noted. Lastly, many of the users of electrical machinery do not give it the attention it requires. They locate motors in places which are dusty or dirty, or difficult of access, and leave them to work as best they may. If motor bearings were made like bicycle bearings, with balls running in vaseline, and if the armatures were regularly blown out, and the brushes attended to, the number of breakdowns would be far fewer than they are."

Turbo-Electric Propulsion for Ships.

At the opening meeting of the Glasgow (Scotland) Students' Section of the Institution of Electrical Engineers, Chairman H. A. Mavor, in his inaugural address, told of his proposed plant for electrical propulsion of ships by plant consisting of steam turbines, generators, and motor-driven propellers.

Mr. Mavor pointed out how skeptical marine engineers were of this type of gear, as its advantages were not apparent from general principles. A constant speed of the ships did not mean a constant power, as the power for any fixed speed altered with load, tide, wind, etc., so that an efficient change gear would result in great economy. With direct steam drives, subdivision of the plant was impossible, while electric driving lent itself to this.

Mr. Mavor's method would consist of high-pressure and low-pressure turbines driving generators having different frequencies, these generators being connected to a motor having a different stator winding for each generator, and each winding having a different number of poles. Thus a series of propeller speeds could be obtained with constant speed on the turbines. In this arrangement there would be no resistances or other wasteful devices used for obtaining speed variation, and the switch gear would be very simple, as no synchronizing would be required.

Electrical Kitchen Machinery on Shipboard.

The steamship *Orvieta,* the second of new Orient liners built by Workman, Clark & Company, Ltd., of Belfast, Ireland, to the order of the Orient Steam Navigation Company, Ltd., for the new Australian Government mail service (to go into force on February 1 next), will shortly be delivered. This steamer, which is thoroughly modern and up-to-date, contains many novel electrical appliances. The following descriptions of some of the kitchen devices are taken from a recent issue of *Engineering,* of London, Eng.:

In the bakery there is an electrically driven dough-mixer, which is capable of mixing flour into dough in fifteen minutes. This consists of a revolving drum, mounted on an electric motor shaft, and having internal bars or kneaders. The baker's oven is heated with steam pipes, which are much cleaner than the fire oven, while the temperature is maintained constant to any desired extent. The area of the oven is forty square feet. There are also special appliances for making pastry.

Another interesting machine is the potato peeler, a machine which consists of a bucket, in the bottom of which there rotates a disk with corrugations covered with corundum. The potatoes are put into the bucket, and the rotation of the disk by reason of its formation, peels all in the machine in five minutes. The disk is mounted on a spindle which is driven by belt from an electric motor. During the process a supply of water flows through the bucket to carry away the peelings.

The dish-washing machines are also an interesting feature. These are designed to deal with 3,000 dishes per hour. The dishes are placed in specially constructed "baskets" designed to suit particular dishes, and thus they do not again require to be touched by hand during the cleaning or drying process. These baskets are lowered into troughs, the water in which is agitated by electrcally driven propellers, and the heat maintained at about boiling point by steam jets.

Electric Drive in Italian Arsenals.

The most important arsenal in Italy for the manufacture of military small arms is located at Terni, near the falls of the same name. There are about 1,400 machine tools in use and electric drive is used throughout the shops. The power is obtained from the falls, where eight turbines generate about 1,000 electrical horsepower. The average number of men employed is less than 1,000, but this can be increased to 2,000 if necessary.

In another Italian arsenal, the "Laboratoria di Precisione," in Rome, which employs about 150 men and where artillery is manufactured, the shops have metal overhead framing for all pulleys and belting, and the drive is electrical throughout.

Experiments on the best methods of utilizing electric drive in machine shops are being undertaken at the present time by the Engineering Experiment Station at the University of Illinois, Urbana, Ill.

The English Mining Situation.

In his monthly notes to the Northumberland (Eng.) miners, Thos. Burt, member of Parliament, discussing the question of electricity in mines, says: "To take the electrical plant and machinery out of the mines is a drastic proposal, and can hardly be regarded as practical. But there is certainly need for greater care and stricter supervision than in many cases have been exercised. What, then, is to be done? The answer is simple; first, stop cheese-paring, and accepting the lowest tender; secondly, put the installation in charge of 'certificated and qualified' engineers, and make them absolutely responsible to the law—not the colliery manager; and, thirdly, appoint competent mines electrical inspectors to see that they (the engineers) are fulfilling their duties, and see that the plant is safely installed and operated. But such inspectors will have to visit the colliery; go below ground; make insulation tests, and give instructions for alterations or recommendations, if necessary. A single inspector for the British Isles is absurdly inadequate. We have hundreds of miles of tramways and railways all worked by electricity, carrying hundreds of millions of passengers annually, yet how often do we hear of fatal accidents to the men operating these? They are very few indeed compared to accidents in coal mines. Yet it is the same electricity! But it is installed and operated by men who know what they are about. Every detail is carefully thought out and considered in all its phases by trained engineers who are alive to their responsibilities."—*From the Engineer and Iron Trades Advertiser* (*Glasgow, Scot.*), *October 19.*

Electric Power in a Scotch Shipyard.

There is at present being put into operation in the shipyard of Wm. Simons & Company, at Renfrew, says *The Engineer and Iron Trades Advertiser* (*Glasgow, Scot.*), a new electric power plant which is interesting as indicative of the very widely extended use of electric power nowadays from power-supply company's mains. This company has dispensed entirely with the use of steam plant, both for shop-driving purposes and generating electric energy, and has installed three-phase, twenty-five-period, alternating current from the Yoker station of the Clyde Valley Electric Power Company. The feeders, at a pressure of 11,000 volts, cross under the bed of the River Clyde at Yoker to Renfrew in duplicate for their ring main system. In the substation in the shipyard there are installed two 500-kilowatt, three-phase, static, step-down transformer units, reducing from 11,000 to 400 volts. The transformer units and all extra high-tension apparatus are completely insulated, but by means of remote-control gear either or both of the units can be put into commission as the leads should necessitate, so reducing the conversion losses to a minimum. Besides the substation with the plan above indicated, there has been installed in the new power house an alternating-current switchboard, a direct-current switchboard, two motor generators, and one rotary converter, as well as two powerful Ingersoll-Rand air compressors, motor- driven by belt for the pneumatic-tool plant throughout the shipyard and boiler works.

A Unique Vacuum-Cleaner Development.

A case in which the electric motor has displaced the cumbersome portable gasoline-engine vacuum-cleaner is reported from Des Moines, Iowa. The credit for the innovation belongs to the Auto Renovator Company in the Hawkeye-State city, which company is using a White steamer car, on the chassis of which is built a special body containing a dynamo and the several electrical regulating devices.

The car carrying the necessary attendants and apparatus is driven from its garage to the building to be cleaned. The dynamo is belted to the driving shaft and generates current which is conducted by means of wires into the room to be cleaned. Here the current operates an electric motor which drives the vacuum apparatus.

This method has been found to be more convenient and economical than the old system of having the vacuum apparatus carried in a vehicle, with cumbersome rubber piping running into the room to be cleaned.

An Electrical Floating Dock.

An electrical floating dock of 11,500 tons capacity is located at Hoboken, near Antwerp, in Germany, says *The Inventive Age,* of Washington, D. C.

The dock has seven centrifugal pumps directly coupled to electric motors, and these high-speed pumps are so powerful that they can raise the loaded dock in ninety minutes. It has a total weight of 4,300 tons, and is constructed in two sections, one having four, and one three pontoons, carrying the two side walls which measure thirty feet in height. The total lifting capacity is twenty-three million pounds.

One of the sections is 277 feet nine inches long and the other is 207 feet eight inches long, and the height of the pontoons is twelve feet ten inches, while the total width of this enormous floating dock is nearly 100 feet. It is owned by the Compagnie des Cales d'Anvers, and is equipped with a most complete electric installation, arc lamps as well as incandescent being utilized, with numerous motors for operating electric machine tools, hoisting apparatus and other labor-saving devices. The high-power arc lamps are fixed on arched poles mounted on the side walls.

Machinery Development in Austria.

The following information concerning the changes which occurred in Austria in motive-power machinery in 1908, as given in the report of the inspector of workshops and factories, is furnished by Consul Joseph I. Brittain, of Prague:

The greatest advance made during the year was in the use of electricity as a motive power. In the north Tyrol and Alpine districts waterpower has been widely utilized through the construction of electrical plants, furnishing many thousands of added horsepower, especially for numerous small enterprises. The inspector for the Voraelsburg district reports that out of 1,200 motor-driven factories 800 are exclusively, and seventy others partially, driven by electrical power. In the same district, where in the early spring there was a lack of waterpower for small factories which did not use electricity, there were many benzine motors used. The Diesel motor attained great popularity in these places. In one district thirteen benzine motors were installed and four Diesel motors. The Diesel motor is constantly increasing its horsepower, and one inspector reports that in his district several of these motors have over 100 horsepower each.

Where great power is required there seems to be a gradual displacement of the piston-action machine by the steam turbine. In the central electric station in one Vienna district four steam engines, each of 800 horsepower, have been replaced by two turbine steam engines of 5,000 horsepower each. In an electrical station in another district four turbine steam engines have been installed, giving 10,000 horsepower. From Reichenberg, Prerau and Troppau come reports of the increasing use of steam turbines.

The city of Bath, Eng., has reduced the price for electricity to photographers.

QUESTIONS and ANSWERS

PECULIAR BEHAVIOR OF INCANDESCENT LAMPS.—While waiting for an elevated train at one of the Union Loop stations one evening last week I noticed a peculiar thing about a group of lamps lighting the platform. At first they were all lit uniformly like the rest of the lamps; suddenly one went out and the others next to it immediately became much brighter than the rest; as a train went by all were lighted equally again. These changes alternated for a long time till I tired of watching them and boarded my train. What could have caused this?—C. H. C., Chicago, Ill.

The incandescent lamps used in lighting the elevated railway platforms, like those used in the cars, barns, stations, etc., of all direct-current electric railways, are wired in sets of five lamps in series and the various sets in parallel across the 500 to 600-volt mains. If one lamp in such a set is burned out, the circuit of that set is broken and all its lamps extinguished. If one lamp in the set is short-circuited it goes out, but the other four lamps burn much brighter because the 500 or more volts is then impressed across only four lamps, so that each receives 125 volts. It is evident that one lamp was short-circuited temporarily, probably at the leading-in wires. The vibrations caused by passing trains opened the short-circuit so that all the lamps of the set again burned normally.

CURRENT RECTIFIER.—What is a current rectifier and what are its uses?—L. L. F., New York, N. Y.

The electrical term rectifier refers to an apparatus which changes an alternating current into a direct current, i. e., rectifies the current. The term rectifier is usually confined to the smaller apparatus used for this purpose, such as the mercury-arc rectifier, the electrolytic rectifier and mechanical rectifier, like the Murphy and Soulier types. Of these three classes the mercury-arc rectifier is the one most generally used, the electrolytic is the least efficient but simplest, and the mechanical types are the ones last developed. For changing alternating into direct current on a large scale machines called rotary converters and motor generators are used by central station and electric railway companies. Rectifiers are used chiefly for charging storage batteries and operating magnetite luminous arc lamps on alternating-current circuits. These batteries and lamps must be supplied with direct current, which, of course, has to be rectified, if it is to be furnished from an alternating-current source.

COLORING INCANDESCENT LAMPS.—What is the best way to color lamps that are exposed to all kinds of weather?—J. T. O., St. Louis, Mo.

There is probably no coloring compound made that can be fully guaranteed to survive the severe test of exposure to all kinds of weather. This property is claimed for several compounds on the market but cannot be entirely substantiated. However, there are some fairly reliable coloring compounds procurable which will give cheaper and more durable results than those obtained with home-made collodion mixtures. It seems to be impossible to get a transparent composition that will positively adhere to the glass under various conditions of moisture and temperature. If the film formed over the glass is thoroughly uniform and elastic it will stand normal weather changes for perhaps several weeks without cracking or flaking. Lack of homogeneity quickly results in chipping and cracking of the film, which is apt to be removed entirely on attempts at cleaning. For lamps that are installed in permanent signs it is much more satisfactory to use bulbs of actually colored glass instead of putting a film of color over ordinary glass bulbs. Such lamps can be obtained in the following natural colors: Green, blue, purple, opal, amber, ruby and canary. The price of such carbon lamps is fifty to 100 per cent greater than ordinary bulbs and they probably cut off a little more light than a collodion film, but they give a clear, uniform light and are indispensable for severe service.

WIRE FOR AN ELECTRIC HEATER.—How can I make an electric heater for 550 volts? What kind of wire, what size wire and how much wire shall I use?—J. T., Alton, Ill.

This problem is very indefinite. In order to advise definitely about the kind, size and amount of wire, as well as about the general construction of the heater, it is necessary to know for what purpose the heater is to be used and the amount of heat it will have to develop in a definite time. For instance, in the case of an electric radiator there should be specified the volume of air that is to be heated from a certain assumed temperature to a definite higher temperature every minute or other known period of time. For a water heater the amount of water and the temperature limits must likewise be known. Similarly for other electric heaters. With these conditions stated it is easy to determine exactly how many heat units must be developed and therefore the resistance and current capacity of the wire best suited for the purpose.

POWER-FACTOR INDICATOR.—Kindly describe a power-factor indicator and its uses.—P. A. B., Chicago, Ill.

A power-factor indicator, as its name suggests, is an instrument that shows what the exact value of the power-factor of an alternating-current circuit is. A description of the construction and principle of operation of such an instrument was given in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of May 15, 1909, page 888. Since the power-factor of an alternating-current circuit is the fraction by which the product of the volts and amperes must be multiplied to get the true power in watts and since this power-factor is numerically equal to the cosine of the angle of lead or lag between the current and electromotive-force, power-factor indicators are used when it is desired to find the exact power used or consumed from the product of the voltmeter and ammeter readings; also when it is desired to know the amount of inductive load and therefore the wattless component of the current; also to ascertain exactly when the inductive load on a circuit has been balanced by the field adjustment of a rotary converter, a synchronous motor, or other synchrous condenser. It is very desirable in alternating-current transmission and distributing systems to keep the current in phase with the electro-motive force. When this is the case the generators, transformers and lines are not burdened with wattless current and therefore are capable of carrying the maximum possible output.

ELECTRICAL Advertising *and* Selling

NEW BUSINESS METHODS OF THE ELECTRIC LIGHT AND POWER COMPANY AT HAMILTON, ONT.

BY G. E. L. CARPENTER.

The Electric City of Canada, is what Hamilton, Ontario, is popularly called. It has won this enviable name by virtue of its cheap electric power and the extended uses to which it has been put in lighting and operating factories and railways. Hamilton is primarily a manufacturing city, with a population of some 75,000 inhabitants. Most of the citizens, and especially the moneyed ones, are of Scotch blood, and in all the business enterprises in the city their shrewdness is apparent.

The Hamilton Electric Light and Power Company, Ltd., which operates the electric-light and power business in Hamilton, gets the current from the Dominion Power and Transmission Company, Ltd. This is generated at its large station about thirty-five miles from Hamilton. The waterpower is derived from the precipitous change of level between Lake Erie and Lake Ontario, formed by the Niagara escarpment. The water is diverted from the Welland Canal at the Lake Erie level, carried through a canal five miles in length, discharged into a forebay, and plunged through steel penstocks 940 feet long against the turbine wheels in the hydraulic station. The impulse wheels are approximately twenty feet above the level of Lake Ontario, the water charges against them under a static head of 269 feet, or 120 feet greater than that at Niagara Falls, and is then returned to the Welland Canal at the Lake Ontario level. The current generated here is sold to the various light and power companies in a territory which is about fifty-seven miles long by twenty miles wide. These companies, in the various towns and cities, are all controlled by the generating company.

In the city of Hamilton, practically all power users are using current bought from the Hamilton Electric Light and Power Company, Ltd., and among the largest consumers of power are the Canadian Westinghouse Company, the International Harvester Company, the Canadian Colored Cotton Mills, the Hamilton Steel and Iron Company, and the Canada Screw Company, besides many other companies manufacturing wire, wire fencing, patent roofing, elevators, meters, patent foods, tools, shovels, carriages, incandescent lamps, etc. All the above manufacturers are securing electric power at a reduction in power cost under steam of from fifty to sixty per cent and a saving of thirty to sixty per cent in the investment that would be required for the installation of individual power plants.

The large use of central-station power in Hamilton has been obtained only after a strong campaign carried on by the company, and the very few users of steam still remaining are slowly but surely being won over. The many industries that have located in Hamilton since the beginning of this campaign are without exception using electric power. Some years ago a municipal industrial committee inaugurated a publicity campaign, advertising the advantages of Hamilton as a manufacturing center, which attracted the notice of and secured a large number of the Canadian branches of American industries. This industrial committee worked in conjunction with the company to advertise the city. This campaign is still being carried on, and new industries are steadily being started. Cheap electric power is not only obtainable, but lighting is also, which has now become quite general in the homes and stores, and when all the meters are set, replacing the flat rate, it is estimated that there will be a meter installed to every ten inhabitants.

In the year 1905 the Hamilton Electric Light and Power Company, Ltd., started its new-business work, and this work was pushed as hard as possible. The force consisted of a contract agent and two solicitors. The city was divided up into two districts, and the solicitors were held responsible for business in their respective territories. They were paid a salary and commission on the amount of business secured.

The advertising was done by newspapers, illustrated folders and pamphlets, and also a follow-up system of direct advertising was instituted. The space in the daily newspapers was used one week with a pointed-remark advertisement, which was changed every week. The folders are issued periodically, and generally advertise electrical appliances. A combined letter and pamphlet follow-up system was also inaugurated, and has worked smoothly, giving good results.

The solicitors make a weekly visit to the building inspector's office and information is obtained on all permits granted to erect or alter buildings. This information is kept at the office and closely followed up, making sure that the building is or will be wired and electric light used. Special attention is paid to see that a building once wired and connected contains a customer, and to help the solicitors in getting into close touch with the new tenant the following plan was carried out: Printed posters are placed in street windows of vacant buildings, advertising that the premises are wired, and post cards, suitably printed, are left in prominent places in the building, which the incoming tenant can send to the office, notifying the company that he has rented the place and would like to secure some information concerning electric light. This plan has worked out very satisfactorily, not only as an assistance to the solicitor, but as direct advertisements, for they can be read from the street. Just before this plan was put into operation a call was made on all the real-estate firms and their co-operation was sought. Their aid was readily granted, they working in thorough accord with the company, realizing that the building advertised as being wired for electric lights will rent much more easily than if it were not fitted for electric conveniences. Electric appliances are advertised, and when a customer appears interested the appliance is sent by one of the solicitors, who explains the advantages and its operation, leaving it for trial.

In November, 1907, the company started in to change over all flat-rate consumers to meter service. This was done as fast as the contracts expired. Some

consumers were lost by the change, as they were getting the current very cheap. The flat rate was thirty-six cents per month per sixteen-candlepower lamp for business purposes and twenty-five cents per sixteen-candlepower lamp per month for residential service. The company had to contend with natural gas at thirty-five cents per thousand feet, and coal gas at $1 per thousand feet. As the new rate which went into effect was something entirely different from any method of charging for current the consumers had experienced before, the company spent considerable time explaining and demonstrating this rate. No new business was sought for specially, as all the time of the contract department was spent in getting the consumers changed over to meter rates and having everything thoroughly explained, so as to avoid any possible loss of consumers through misunderstandings. The company has, through the newspapers, made public all the little details in regard to the meter service. An advertisement was run in each of the three daily papers, using considerable space.

The rate for commercial electric-light service is as follows: Base rate, four-and-one-half cents per kilowatt-hour and, in addition thereto, the following fixed charges:

RATE PER LAMP PER MONTH.

4-candlepower incandescent carbon-filament lamps	$0.04
8-candlepower incandescent carbon-filament lamps	.07
16-candlepower incandescent carbon-filament lamps	.10
32-candlepower incandescent carbon-filament lamps	.20
4-ampere arc lamps	.80
6.5-ampere arc lamps	1.00
1-glower Nernst lamp	.20
2-glower Nernst lamps	.40
3-glower Nernst lamps	.60
4-glower Nernst lamps	.80
6-glower Nernst lamps	1.20

Fixed charges on other lamps, such as tungsten, etc., in proportion to their wattage consumption to the expenses here listed.

The consumer further agrees that the minimum monthly charge payable under this contract shall be seventy-five cents net, and also pays a monthly service charge of twenty-five cents net for the use of the meter and service connections. From these charges there is a ten per cent discount allowed, off current consumption only, upon bills paid within ten days. A practical example showing how this rate is operated follows: A consumer has a four four-candlepower lamp installation and his consumption for one month is ten kilowatt-hours, the account would be calculated thus:

Current consumption as per meter, ten kilowatts at a four-and-one-half-cent rate is forty-five cents, plus sixteen cents fixed charge for four four-candlepower lamps, plus fourteen cents minimum charge, plus twenty-five cents service charge, makes the bill one dollar. No fixed charges are made on any current-consuming appliances connected to this meter under this rate other than expenses.

For domestic or residential lighting there is a sliding-scale rate based on consumption. There is a monthly minimum charge of fifty cents per month and a service or rental charge of twenty-five cents per month per meter. The company allows ten per cent discount for prompt payment within ten days. The rate is as follows:

KILOWATT-HOURS CONSUMPTION PER MONTH.

Hours.	Gross Rate.	Hours.	Gross Rate.
10	$0.085	110	$0.075
20	.084	120	.074
30	.083	130	.073
40	.082	140	.072
50	.081	150	.071
60	.08	160	.07
70	.079	170	.069
80	.078	180	.068
90	.077	190	.067
100	.076	200 and over	.066

The company has also a wholesale or large consumers' special rate, which is open to anyone. This rate is as follows: The consumer agrees to pay for current at the rate of two-and-one-half cents per kilowatt-hour and guarantees that—

WATT CONSUMPTION PER LAMP PER HOUR.

4-candlepower incandescent lamps	20
8-candlepower incandescent lamps	35
16-candlepower incandescent lamps	60
32-candlepower incandescent lamps	115
4-ampere arc lamps	350
6.5-ampere arc lamps	550
1-glower Nernst lamp	90
2-glower Nernst lamps	180
3-glower Nernst lamps	270
4-glower Nernst lamps	360
6-glower Nernst lamps	540

The minimum monthly charge payable under this contract shall be based on $5 per kilowatt consumption per month on connected capacity. There is also a monthly meter-service charge of twenty-five cents net. The ten per cent discount for payment within ten days is also allowed. The lowest minimum possible under this rate is $2.50 (not including meter rent), equal to one-half kilowatt.

A practical example showing this rate in operation with a ten sixteen-candlepower lamp installation would show that the monthly minimum charge for the installation would be $3 per month. The minimum charge always applies unless the total installation is used more than eight hours per day thirty days per month. Should the minimum not apply, the customer is paying two cents net per kilowatt-hour for his lighting. The power rate is as follows, providing he pays his accounts promptly:

Base rate, three cents per horsepower-hour.

The minimum monthly charge is seventy-five cents per horsepower connected, in addition to a monthly meter rental, based on size of meter.

Horsepower per Month.	Per Cent Discount.	Net Rate.
100	0	$0.03
200	7	.0279
300	15	.0255
400	23	.0231
500	30	.021
600	35	.0195
700	39	.0183
800	41	.0177
900	43½	.01695
1,000	46	.0162
1,100	48	.0156
1,200	49½	.01515
1,300	51	.0147
1,400	52½	.01425
1,500	54	.0138
1,600	55	.0135
1,700	56	.0132
1,800	57	.0129
1,900	58	.0126
2,000	60	.0120
2,100	60¾	.011775
2,200	61½	.01155
2,300	62½	.01125
2,400	63	.0111
2,500	64	.0108
2,600	65	.0105
2,700	65½	.01035
2,800	66	.0102
2,900	66½	.01005

On an installation of fifty horsepower and upward the rate is one cent net per horsepower-hour.

On an installation of fifty horsepower and over the rate is three-fourths of one cent net per horsepower-hour, providing contract contains clause of restricted period (from October 1 to March 1, no current to be used between 5 and 6:10 p. m.).

The company renews all incandescent lamps and furnishes the first installation free. The electric-sign business has not been thoroughly developed and steps will be taken shortly to push this end of the business further. Flatirons have not received any special attention, such as a special campaign, but there are about 550 irons and heating appliances in use today. The Hamilton Electric Light and Power Company, Ltd., expects to register one of the largest years in point of new business secured, next year. The electric-lighting end will receive special attention. The City Council has not forgotten that to demonstrate that cheap electric power and light is obtained in Hamilton, as much use as possible should be made of the current to illuminate the city streets and parks. One result of this advertising was the illuminating of one of the city parks by about 1,600 eight-candlepower incandescent lamps colored red, white and blue. This particular illumination is lighted every night from dusk until midnight, for which the city pays a nominal charge. This has brought the merchants to believing that electric advertising out of doors is profitable publicity, with the result that the business streets are brilliantly lighted with arc lamps, electric signs and outline lighting.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

AMERICAN TELEPHONE AND TELEGRAPH.

The Associated Bell Operating Companies of the American Telephone and Telegraph Company, not including the long-distance lines of the American Telephone and Telegraph, report for the month of September and nine months ended September 30, as follows:

	1909.	1908.
September gross	$11,462,336	$10,565,053
Operating expenses and taxes	4,642,686	4,464,949
Balance	$ 6,769,650	$ 6,100,104
Maintenance and depreciation	3,405,276	2,907,231
Net	$ 3,364,374	$ 3,192,873
Interest	560,186	622,674
September surplus	$ 2,804,188	$ 2,570,199
Nine months gross	99,834,450	92,773,087
Operating expenses and taxes	41,115,143	40,106,841
Balance	$58,719,307	$52,666,246
Maintenance and depreciation	31,271,194	26,357,635
Nine months net	$27,448,113	$26,308,611
Interest	5,091,471	5,766,926
Nine months surplus	$22,356,642	$20,541,685

In 1909 all maintenance and depreciation is charged for by an extraordinary charge in December as heretofore. In order that a true comparison may be made between 1908 and 1909, the 1908 figures as above presented include in expenses for each month one-twelfth of the extraordinary provision for depreciation which was made in December, 1908. The unexpended portion of the provision made for depreciation for the first eight months of 1909 was $9,979,134, which is not counted as profits, but remains as a reserve for future replacements.

NEW YORK EDISON COMPANY.

The New York Public Service Commission has issued a report covering the operations of the New York Edison Company for the year ended December 31, 1908, as follows:

Operating revenue		$15,228,716
Operating expenses and taxes		9,087,680
Net operating income		$ 6,141,035
Non-operating income		1,014,436
Total income		$ 7,155,471
Interest, rentals, etc.		3,250,767
Net corporate income		$ 3,904,703
Previous surplus		12,849,628
Total surplus		$16,754,332
Deductions from surplus:		
Dividends	$2,703,060	
Adj. Bronx from taxes	1,505	
Total	$2,704,565	
Additions to surplus:		
Damage suits	12,600	
Miscellaneous items	220	
Electric Testing Laboratory, stock dividend	12,780	
Coupon interest and interest on unpaid coupons of Cosol. Tel. & Elec. Sub. and Yonkers Electric Light & Power	760,178	
Total	$ 785,778	
		$ 1,918,785
Surplus December 31, 1908		$14,835,547

PUBLIC SERVICE CORPORATION OF NEW JERSEY.

President Thomas N. McCarter of the Public Service Corporation of New Jersey has given out a statement of the earnings of the corporation covering the twelve months ended September 30, 1909. This is the first report of the earnings of the entire system of the Public Service Corporation that has been made public:

Gross (including miscellaneous income)	$25,921,892
Operating expenses, taxes and rentals and fixed charges of leased and controlled companies	23,235,533
Net earnings	$ 2,686,359
*Interest on Public Service Corporation securities	1,681,132
Surplus	$ 1,005,227

*Includes interest on convertible and collateral notes which have since been retired, reducing the annual interest charges to $1,564,468.

The gross earnings of the Public Service Corporation for the nine months of 1909, and four calendar years preceding have been as follows:

1909 (nine months)	$19,286,261
1908	24,267,687
1907	23,628,044
1906	21,498,826
1905	19,949,842

LONG ACRE ELECTRIC LIGHT.

The New York Public Service Commission has issued a report covering the operations of the Long Acre Electric Light and Power Company for the year ended December 31, 1908, as follows:

Gross operating revenues	$ 3,804
Operating expenses, taxes, etc.	24,391
Total operating deficit	$20,586
Rentals, etc.	25,890
Deficit	$46,476
Previous deficit	28,798
Deficit December 31, 1908	$75,275

WESTERN ELECTRIC COMPANY.

October sales booked by Western Electric showed a material improvement, totaling nearly $4,500,000, or at the rate of $53,000,000 per annum.

In fact, October gross was the largest of any single month since May, 1907, and recorded the first distinct increase in orders for the last six or seven months. Business received was nearly $1,500,000, or fifty per cent greater than in October, 1908.

For the eleven months period Western Electric sales have been at the rate of slightly better than $47,000,000 per annum, an improvement of forty-three per cent over the same eleven months of last year.

For the 1907 and 1908 fiscal years Western Electric failed to show the eight per cent dividend on its $15,000,000 stock fully earned. It is very probable that this year, however, the company will be able to show the eight per cent dividend fully earned, with some surplus to the good.

Gross sales for the full year to end November 30 of rising $47,000,000, would compare with $33,000,000 last year, an increase of forty-five per cent, and coming, as much of the gain has, during the last six months, leads to the expectation that the company will book over $55,000,000 gross in the next fiscal period, or more than in 1907.

A factor helping Western Electric earning has been the steady advance in prices, not so much in telephone supplies as in general electrical apparatus, sales of which for the eleven months have been forty per cent greater than a year ago.

TWIN CITY RAPID TRANSIT.

W. W. Winter, president of the Brooklyn Rapid Transit Company, has returned from a two weeks' trip through the Middle West, during which he went over the lines of the Twin City system. He says of this property:

"It is an excellent system, well kept up and rightly managed. Conditions surrounding the operation of a street-railway line out there are much easier than in this part of the country, but that does not detract from the credit due the Twin City. It is not a criminal offense in Minnesota for capital to earn a fair rate of interest."

AMERICAN LIGHT AND TRACTION.

The American Light and Traction Company, for the convenience of its stockholders, is trying out the policy of dealing in its own warrants, which are issued to common stockholders for fractional parts of a share in payment of stock dividends, and of granting to holders the right to purchase full shares of stock by paying the fractional difference in cash. Both transactions are conducted at a certain definite rate per share, which rate is below the current market value of the stock.

It is interesting to note how this plan worked out in the case of the ten per cent stock dividend paid on the $8,279,000 common stock in August.

Certificates of stock for 8,033 shares were issued to stockholders who had ten or a multiple of ten shares, and warrants for fractions aggregating 246 shares were issued to those holding fractional parts of ten shares.

Holders of 214 warrants, aggregating seventy-three shares, sold their warrants to the American Light and Traction Company at the rate of $235 per share; 335 holders of fractional warrants, aggregating 151.7 shares, paid the fractional dif-

ference at the same rate and each secured a full share, and forty-one fractions, aggregating eighteen shares, were exchanged even for that amount of stock. This makes a total of 353 shares issued in exchange for warrants aggregating 246 shares, or 107 shares more than were called for by the stock dividend. Warrants aggregating about fourteen shares were still outstanding when the November dividend was declared. These will now be treated the same as the November warrants.

The American Light and Traction Company has 987 common stockholders, 306 of whom hold over forty shares and 681 under that amount.

The Mackay Companies.

A report from New York states that the new cable of the Commercial Cable Company between New York and Newfoundland, laid to facilitate the transatlantic business, has proved a great success, according to officials of the Mackay Companies. It is not improbable that within a comparatively short time further cable connections will be made between the two points on the American continent, since both as time saver and a means of greater accuracy in transmission the Newfoundland route has more than justified the expenditures incurred.

While there has been a decided increase in business, there is, however, nothing to indicate that the dividends are to be raised beyond the four per cent rate, which has prevailed since 1904, for the preferred stock. Dividend payments on the common shares began in 1905 and were increased to four per cent in 1906. It has been semi-officially stated that the earnings would justify a larger dividend rate.

President Mackay was in the West, and it appears that since the Atlantic cable service received a great deal of attention during the earlier part of the year, the land lines are now to be favored similarly. The further building up of the Pacific Coast system is known to have for some time claimed the attention of the management.

Mr. Mackay's recent journey through the Western states has afforded an opportunity for the inspection of more than 10,000 miles of wires, and with the information he has gathered from this tour of inspection he will be in a position to make a detailed statement for the annual report, which is issued at the end of the fiscal year, January 30, 1910.

Associated Gas and Electric.

A controlling interest in the Associated Gas and Electric Company, of Ithaca, N. Y., has been acquired by W. S. Barstow & Company, of New York, with offices also in Portland, Ore. At the present time the Associated Gas and Electric Company has authorized $5,000,000 of collateral bonds, of which there are issued: $1,500,000 of debenture bonds, of which there are $225,000 issued; six per cent cumulative preferred stock authorized $1,000,000, of which there is $500,000 issued; common stock authorized $1,000,000, of which $600,000 is issued. The total securities of these companies to be taken over are $1,950,000 stocks and $1,717,000 bonds.

The officers of the Associated Gas and Electric Company, which will continue in existence and control the properties above mentioned are: W. S. Barstow, president; William T. Morris, vice-president; O. Clement Swanson, treasurer; Jos. B. Taylor, secretary; T. W. Summers, general manager.

Electric Road Mortgaged.

The Oregon Electric Railway Company of Oregon City recently filed a supplemental mortgage in behalf of the Columbia Trust Company of New York, as trustee, covering all of the property of the railway company that has been acquired since the original mortgage was given. The instrument was made to secure the payment of a bond issue of $10,000,000. Of this authorized issue of bonds only $2,000,000 have been sold. The supplemental mortgage embraces the Forest Grove division of the Oregon Electric Railway Company, covering 6.83 miles, and includes lands and franchises in Forest Grove, Hillsboro, Cornelius and Beaverton.

Michigan Telephone Companies Must Report Earnings.

Attorney-General Bird, of Michigan, has recently furnished the State Tax Commission with an opinion, in which he states that all telephone companies must make an annual report to the commission. Many small telephone companies have, in the past, refused to do this on the ground that their gross earnings do not exceed $500.

Mr. Bird said further, that, while the company might be in the best position to state its financial condition, it was the business of the commission and not of the company to determine the gross earnings officially.

Tramway Electrification in Russian Capital.

Consul James W. Ragsdale advises that an effort to sell the tramways of St. Petersburg to private parties caused the Municipal Board to take quick action to prevent it, and provide means for electrifying the extensions and those portions of the roads now operated by horsepower.

The second relay will include trackage of 64.6 versts (verst equals two-thirds of a mile), or a little more than the trackage now run by electricity. The cost of building the lines of the second relay will amount to 20,040,000 rubles (ruble equals 51.5 cents), against 18,600,000 rubles, the cost of the first relay for 54.3 versts. The revenues of the system, when extended, it is estimated, will aggregate 14,300,000 rubles, and the expenses 6,000,000 rubles. After deducting interest and cost of liquidation of loans, the net profit is estimated at 2,300,000 rubles, or 4.2 per cent on the capital invested. It is expected that the extension will require three years to complete, and when finished horsepower on any street-car line in St. Petersburg will be a matter of the past.

Denies Claim of $7,450,000.

The Interborough-Metropolitan Company denies that it owes the New York City Railway Company a balance of $7,450,000 on stock according to its answer to the suit of William W. Ladd, receiver for the New York City Railway. It asserts that the Metropolitan Securities Company, by which the New York City Railway stock was handled as a holding company, owes to the Interborough-Metropolitan $8,201,862.83 for money lent and advanced to the Metropolitan Securities Company for its corporate purposes.

Receiver Ladd already has obtained judgment against the Metropolitan Securities, and that company is trying to reverse the judgment.

King's County Electric Bonds.

At a special meeting of the stockholders of the Kings County Electric Light and Power Company, the proposition to issue $5,000,000 par value convertible six per cent debenture bonds was ratified. The bonds will be dated on or about January 1, 1910, and payable on or about January 1, 1922, and convertible into the stock of the company at par at the option of holders, or on and after January 1, 1913, and before January 1, 1922. The debentures will be offered to the stockholders at par in proportion to their holdings of stock.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

New Single-Phase Motors.

It has now become common practice for both central stations and isolated plants, employing polyphase generating units, to feed large portions of the lighting circuits as well as that part of the power load required for machinery of moderate capacity, through single-phase distribution lines.

Fully recognizing the permanent field for single-phase motors, the General Electric Company has paralleled its well-known polyphase design with two lines of single-phase motors. The KS type is well known, and thousands are now in successful operation. The RI motors of the repulsion induction type will be described here.

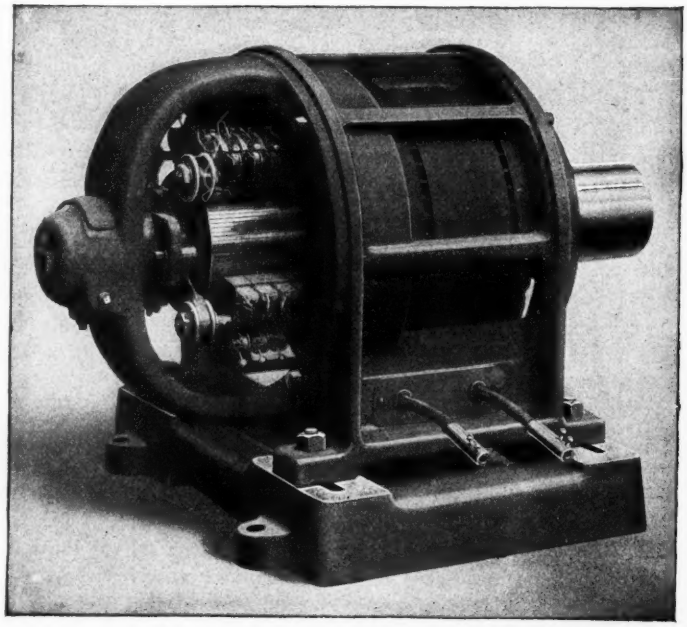


FIG. 1.—TYPE RI REPULSION MOTOR.

In general, the type RI motor is distinctly adapted to the operation, by belt, gears or rigid couplings, of all machines requiring constant or variable speed and moderate or heavy starting torque. They are entirely automatic, and may be thrown on the line without the interposition of any starting box, clutch cupling, or other external device.

RI motors are built in the unique and well-known open frame form, in which the laminations of the stator core are clamped between cast-iron flanges held in the frame to which the end heads are secured. This construction provides a most simple and effective method of natural heat radiation, since the laminated stator disks are exposed directly to the air. In addition, all inactive material is thus eliminated, weight is reduced, and without sacrificing rigidity, efficiency, or quality in any respect, the motor is made exceedingly compact and more readily accessible for cleaning than the older box-frame type. Also, pockets for the accumulation of dust are avoided.

The field of the RI motor is wound with a single-phase winding of the concentric type, each coil being taped and insulated separately. When completed, the stator coils receive a japan and baking treatment to render the insulation impervious to ordinary dampness or moisture.

To facilitate connection to circuits of either 110 or 220 volts four plainly tagged leads are brought out to the back of the removable terminal board.

The RI armature winding is of the series drum type connected to a commutator carrying two sets of brushes, each set being displaced electrically from the other by ninety degrees. The first set, known as the energy brushes, is permanently short-circuited and disposed at an angle to the lines of field or primary magnetization, as in an ordinary repulsion motor. The second set, or compensating brushes, is connected to a small portion of the primary winding included in the field circuit, so as to impress upon the armature an electromotive-force which serves both to raise the power-factor and at the same time maintain approximately synchronous speed at all loads.

The armature laminations are built up on a cast-iron sleeve having the same inside bore as the commutator. In case the shaft becomes damaged or worn, it can be readily pressed out and replaced without disturbing the commutator or windings.

The bearings are of the oil-ring type and of ample size to minimize wear and insure cool operation. Solid rings are used, which revolve loosely on the shaft and dip into reservoirs of proper capacity to provide constant lubrication of the journals and linings. The reservoirs are fitted with visible gauges to indicate the amount of oil, and with taps for drawing off the lubricant when required.

As will be noted, the double-arm construction of the bearing heads permits ready access to all parts of the commutator and brush-gear.

The standard method of interchangeably spacing the end-head retaining bolts is used, allowing the motor frame to be shifted ninety or 180 degrees for wall or ceiling suspension, as desired.

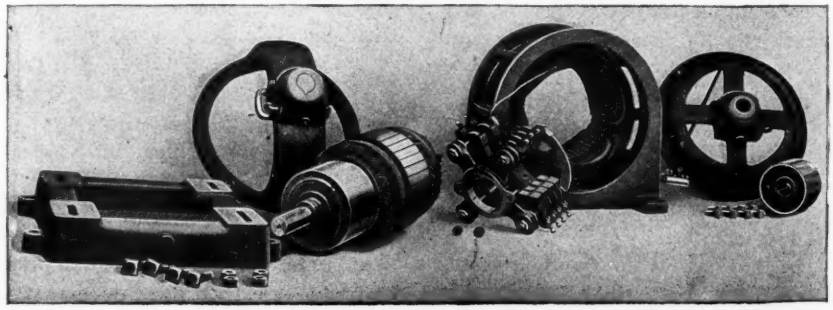


FIG. 2.—TYPE RI MOTOR DISASSEMBLED.

Standard RI motors are wound for sixty cycles and are interchangeable for

110 or 120 volts, with capacities of one-half, one, two, three, and five horsepower. The full-load speed is as follows: One-half-horsepower, 1,625 revolutions per minute; one-horsepower, 1,720 revolutions per minute; two-horsepower, 1,725 revolutions per minute; five-horsepower, 1,625 revolutions per minute.

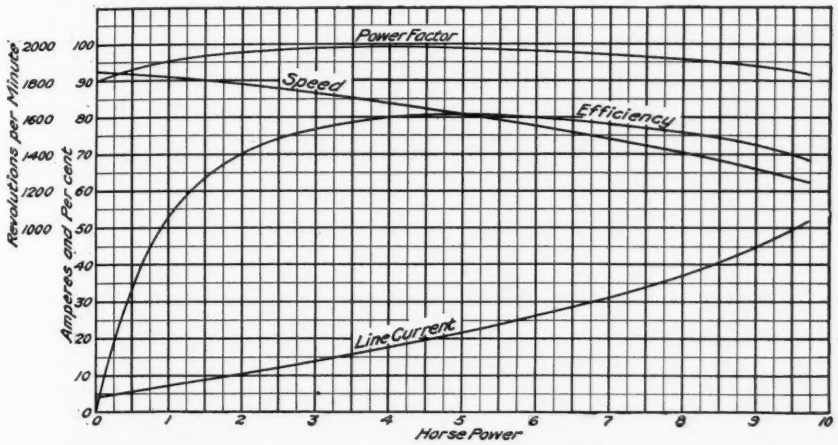


FIG. 3.—CHARACTERISTIC CURVE OF FIVE-HORSEPOWER TYPE RI MOTOR.

A study of the curve, Fig. 3, covering the performance of a standard five-horsepower RI motor will show at once the remarkably high and well-sustained power-factor and efficiency characteristics of the RI motors.

RI motors can be furnished with controllers to give a speed variation of fifty per cent below synchronous speed by inserting resistance or reactance in the energy and compensating circuits. With the exception of the leads brought out from these circuits, the constant-speed and variable-speed motors are identical. Reversible motors can be furnished at the slight additional cost of a special winding having terminals for connection to a four-pole double-throw switch.

The CR-118 rheostats are designed for starting duty only, and are recommended for operating these motors on circuits where it would be objectionable to throw the motor directly on the line. A no-voltage release coil allows the rheostat starting arm to automatically return to the "off" position in case of line-voltage interruption. The CR-172 controllers are designed to give speed reduction and speed increase, as resistance is inserted in the energy and compensating circuits.

Fig. 5 illustrates the controller for use with one and two-horsepower, 110 and 220-volt motors. The resistance for the compensating circuit is self-contained, while an external resistance is required for the energy circuit. The rheostat has renewable segments and is furnished with a cover which completely encloses the slate front.

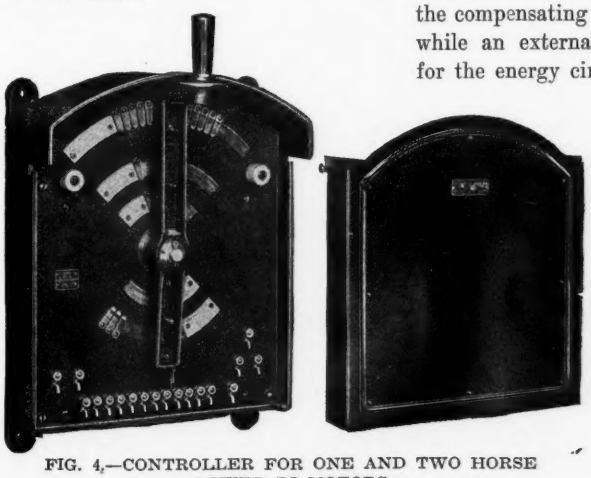


FIG. 4.—CONTROLLER FOR ONE AND TWO HORSE POWER RI MOTORS.

The controllers for three and five-horsepower, 110 and 220-volt motors are shown in Fig. 6. The resistance for the compensating circuit is self-contained, while the resistance for the energy circuit is external, being assembled in a well-ventilated sheet-iron box suitable for mounting on the wall. These controllers have an enclosing cover, renewable segments and in addition are supplied with an alternating-current contactor. The contactor acts as a no-voltage release and also makes and breaks the motor circuit, thus preventing arcing on the switch contacts.

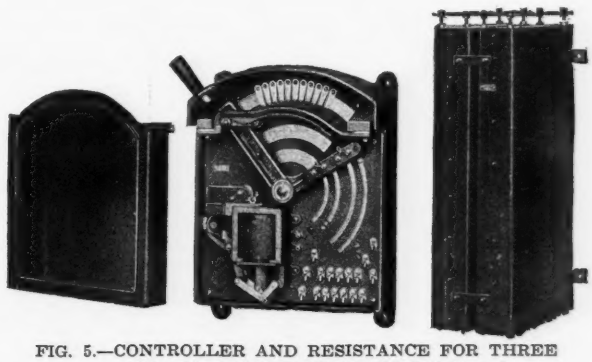


FIG. 5.—CONTROLLER AND RESISTANCE FOR THREE AND FIVE HORSEPOWER MOTORS.

At present the RI motors are built in five sizes, one-half, one, two, three and five horsepower.

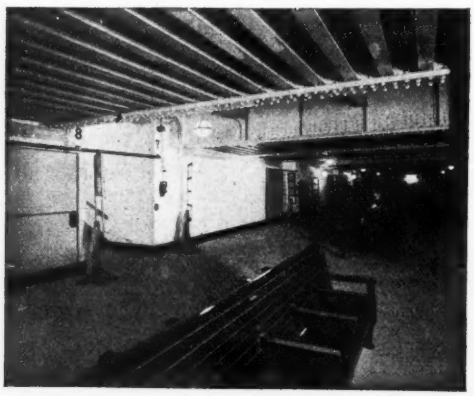
The advantages of this type of motor may be briefly stated as, noiseless operation, attractive design, improved ventilation, excellent heating and overload characteristics, compact and rigid construction, least weight consistent with proper mechanical strength and the sustaining of high electrical constants, self-starting with rapid acceleration, and wide speed control.

Westinghouse Business Increasing.

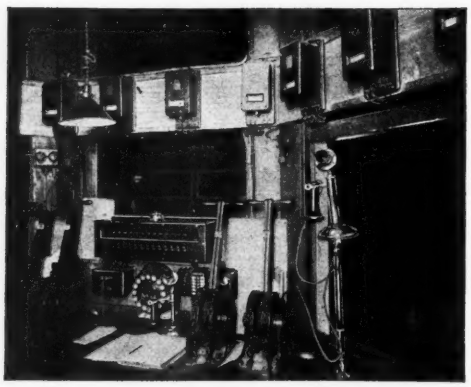
The first six months of the current fiscal year of the Westinghouse Machine Company, which ended last month, showed a business volume representing the second largest in the history of the company for a similar period. From present indications, it is confidently expected that the next six months will, however, show a much better result. This is due to the fact that business conditions generally are constantly improving, and also because the company has taken on several new lines of product within the last year, now fully developed, and the exploitation of which is greatly enhancing the volume of output. Indeed, forty per cent of the business done by the company in recent months is represented by these new lines. In addition, the revival of the electric-railway business from the financial depression is the source of many new orders which the company is now obtaining. One of the chief officials of the Machine company, speaking of the prospects, said recently: "There is every indication that the volume of our business will reach its normal figures again by the beginning of the new year."

An Intercommunicating Telephone and Train Despatching System at the Erie Terminal, Jersey City.

It is a well-known fact that the telephone is rapidly replacing the telegraph instrument for railway train despatching. The intercommunicating telephone, on account of its economy of time and labor, is also recognized as the chief aid of the modern business man. A combination of the two, using an intercommunicating telephone system for train despatching, is, however, indeed a novel installation. Such is the use to which one is put at the Erie Railroad terminal, Jersey City, N. J. To make it more interesting, these telephones are also the connecting link between the Erie Railroad's suburban system, which terminates at Jersey City, and the Hudson & Manhattan Railroad Company's tunnel trains running from that point under the Hudson River to New York city.



VIEW OF GATES.

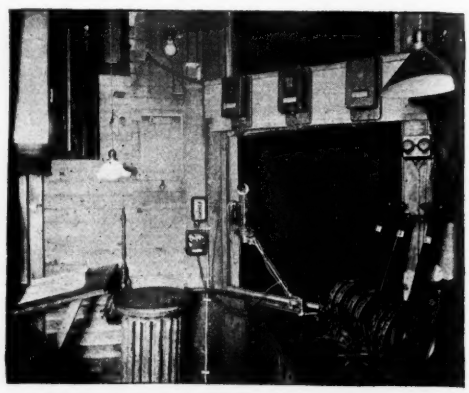


INTERIOR OF DESPATCHING TOWER, SHOWING GATE-CONTROL SYSTEM.

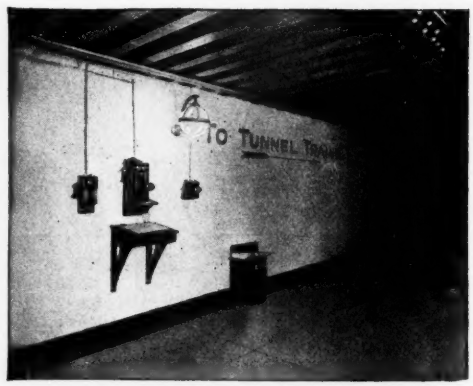
At the Erie station end of the train sheds, overlooking them, is built the despatching tower. The interior of this is shown in two photographs, the two views overlapping. At the right of the view of the northern end of the tower is seen mounted on an equipoise arm, the desk set of the gate-control system. The ringer and the key box connected with this set are shown side by side behind one of the levers mounted on the tower desk, and to the right of a second telephone seen in the center of the photograph. On the gate-control system are the tower telephone and five wall-type intercommunicating sets, one at each stairway leading from the concourse floor to the train shed. One of these is shown at the left of the group of three in the photograph of the end of the concourse. Others are seen in the general view of the concourse. All of these sets are built according to the latest designs of the Western Electric Company, which manufactures all of the telephones used in the "Bell" system. Each of the sets has an ultimate capacity of eleven connections. The conductors connecting each set with all of the others are carried throughout in cable, the conductors being insulated with double silk and single cotton, differently colored for identification. As much of the cable is laid where it is exposed to moisture, it has a lead cover.

The operation of this part of the system is as follows: The suburban passengers from the Hudson tunnels enter the concourse through the subway, but are kept from going into the trainsheds by the closed gates at the stairways. We will assume that the passengers live in Bloomfield and Montclair, and the train to these places is to leave track No. 8. The despatcher presses the button marked track No. 7 and No. 8 on his key box. This act automatically connects his set with the one at the gate for track 7 and 8 and rings the bell. When the guard answers the call he tells him that the train for Bloomfield will back into track 8. The guard puts up the sign on the rack to indicate this. A few minutes later the train is ready, and the despatcher rings the gong over the gate to notify the guard of the fact. The guard, after pressing one of the two buttons to be seen under each stairway telephone corresponding to the track number, opens the gate. Should the button pressed show the despatcher that the guard did not understand correctly which of the tracks is to be used, or if there is any misunderstanding, he can always easily reach the guard by use of the intercommunicating telephone.

The gongs referred to are controlled from the despatcher's office by means of the long box shown in front of the window in the interior view of the tower. The buttons at the bottom control the gongs for the ten tracks referred to and the four additional tracks in the train sheds. When the guard answers by pushing the bell button under his telephone, the bell on top of the control box rings and a corresponding numbered drop appears in the row of drops at the top of the box. This box is of special design and was built by the Western Electric Company.



INTERIOR OF DESPATCHING TOWER.



TELEPHONE INSTALLATION IN CONCOURSE.

In the view of the southern end of the despatcher's tower is the desk set, ringer and key box of a second intercommunicating system. Five sets are at present connected with the system, namely: Train Master, Division Master, Terminal Tower, Engine Yard and Passenger Yard. These have proven sufficient for the despatcher to keep in touch with all the details of train make-up and handling of special work.

In the center of the first referred to view of the tower is seen a desk tele-

phone. This is connected to a three-plug magneto party system, which was in use before the volume of traffic demanded the installation of the new system. This is kept in place for emergency use.

Another photograph shows the desk of the chief attendant in the concourse. The set to the left is for tracks No. 1 and No. 2 on the gate-control intercommunicating system. The wall-type magneto set, in the center, is connected with a similar set on the platform of the Hudson tunnels, and is used to keep in touch with the arrival of the tunnel trains. The third set, farthest to the right in the illustration, is on another system maintained by the Hudson tunnels.

It is found that not only does this system do rapidly, and with a minimum effort on the part of the despatcher, the work for which it is intended, but, by keeping the men in conversational touch with each other, it forms practically a unit of them. No doubt similar equipments will be installed in other terminals in the near future.

Gas-Electric Motor Cars for Southern Railway.

The General Electric Company has sold to the Southern Railway Company two of its latest type of gas-electric motor cars. These cars are equipped with standard commutating-pole railway motors of 100 horsepower. Two of these motors are located on the forward truck, giving a motor capacity of 200 horsepower to each car.

The current is supplied from a 600-volt generator, which is direct-coupled to an eight-cylinder gas engine in the forward compartment. A controller similar to that used on an ordinary trolley car is located convenient to the operator, and through this the current passes from the generator to the motors. Combined straight and automatic air brakes are provided, with the usual valves and accessories. The car bodies are of steel, about fifty-five feet long, with seating room for fifty-two passengers. Both rear and center entrances are provided, thus furnishing a convenient means of dividing the two classes of passengers, as required in the South. The cars are illuminated by electric light throughout.

The order for these cars was placed with the General Electric Company after a thorough test of this type of car between Manassas and Strasburg, Virginia, last summer.

New Types of Holophane Reflectors.

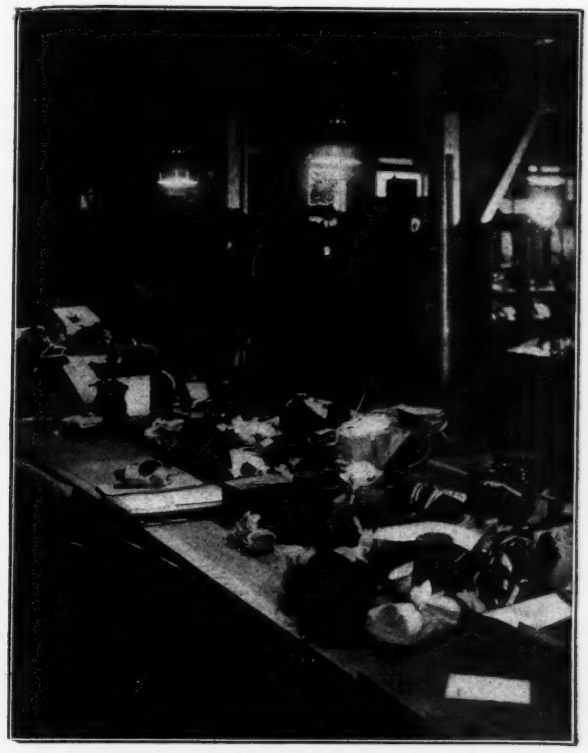
The new extensive and intensive types of Holophane-D'Olier steel reflectors, manufactured by the Holophane Company, Newark, Ohio, and illustrated herewith, permit the use of standard-voltage tungsten lamps for industrial lighting. These reflectors, giving as they do the characteristic distributions of the Holophane "high-efficiency" glass reflectors, enable the illuminating engineer to undertake mill and factory lighting problems in the same way as he would handle a residence or commercial problem.

The new Holophane-D'Olier reflectors, being designed upon scientific lines, have created a demand for their use in factory lighting. It is definite, practical illuminating results at which the shrewd present-day factory manager looks. He has, in the past, bought lamps and "shades." Today he is demanding adequate and economical illumination.

Extensive Type.

Intensive Type.

NEW TYPES OF HOLOPHANE-D'OLIER STEEL REFLECTORS.



AN INSTALLATION OF HOLOPHANE-D'OLIER STEEL INTENSIVE REFLECTORS IN SHOE FACTORY.

Tungsten lamps have heretofore not been available to any considerable extent for industrial lighting because of the high percentage of breakages. Workmen could not be taught to handle the lamps carefully. The extensive and intensive Holophane-D'Olier steel reflectors, however, enable the lighting engineer to install tungsten lamps safely, as these reflectors give the best results when the units are hung high and out of the workmen's reach.

These new reflectors mark another step in the progress of Holophane illumination. While they are of such exact design as to commend themselves to the illuminating engineer, it requires no expert skill or deep engineering knowledge to use them with complete satisfaction wherever the "group-lighting" or "distributed-unit" system of lighting is desirable.

The Largest Self-Cooling Transformer Ever Built.

The maximum size for which a transformer can be built self-cooling is limited by the amount of heat-radiating capacity for which the case can be designed. Standard cases with corrugated sides are regularly supplied with transformers up to about 600 or 750 kilovolt-amperes, but beyond this size the weight and size of the case become so great that some method, other than mere increase in size, must be resorted to in order to get the necessary radiating surface.

A type of case recently developed by the Westinghouse Electric and Manufacturing Company overcomes this difficulty and is capable of being designed for a greater radiating capacity than has ever been attempted for a self-cooled transformer. It consists simply of a plain boiler-iron case to the outside of which are welded a number of radiating tubes. These tubes are in the vertical position

and are given a ninety-degree bend at the top and bottom where they enter the case. The mechanical construction is very strong, so that there is practically no chance of ever springing a leak. Because of the ease with which the tubes can be widely separated from one another, the air circulates very freely among them, and the efficiency of the radiating surface is higher than for the corrugated case.

There is a growing demand for large self-cooled transformers in substations and other places where water for cooling purposes is either not available or else very

LARGEST SELF-COOLING TRANSFORMER EVER BUILT.

costly, or where weather conditions are so severe that water-cooled transformers may give trouble, or where it is desirable to have as little attendance as possible.

The Westinghouse Electric and Manufacturing Company has just built twelve 1,000-kilovolt-ampere, 100,000-volt transformers of this type, shown in the illustration, for the Southern Power Company; three of these transformers are for outdoor service and nine for indoor use.

Copper Exports.

Exports of copper for the week ended November 11 were 7,143 tons. Since November 1 they were 8,084 tons, compared with 6,423 tons the same period last year.

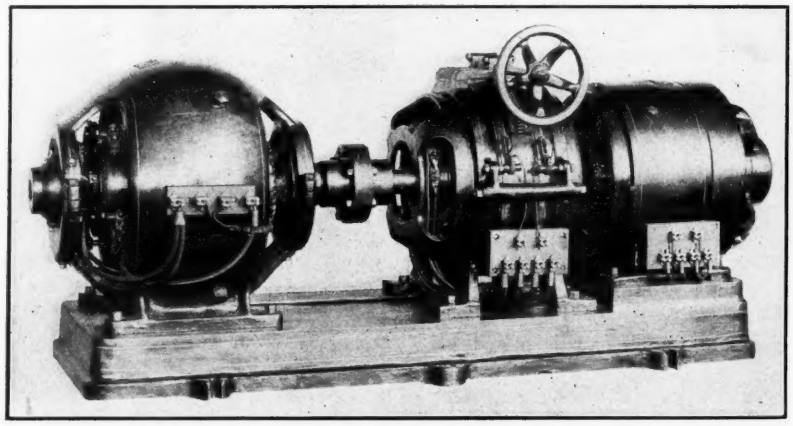
Special Motor-Generator Set.

A motor-generator set has recently been installed in the testing department of the Commonwealth Edison Company, Chicago, which on account of its special design and construction is worthy of consideration.

The motor-generator set under discussion is illustrated on this page. The motor is of the adjustable-speed type, capable of operating the two alternating-current generators at a speed of from 750 to 1,800 revolutions per minute, thus giving frequencies ranging from twenty-five to sixty cycles. The generators furnish alternating current of true sine wave, the one at the extreme right is wound for 110 volts and the other for fifty volts. The fifty-volt machine is arranged in such manner that the field rings supporting the pole-pieces may be rotated through 180 electrical degrees. The frame is supported on substantial bearings contained in the end brackets and is rotated by a worm-gear attachment operated by hand wheel. This outfit is used for calibrating alternating-current wattmeters.

The pressure coil of the wattmeter is connected to the high-voltage machine through suitable transformers. The current coil of the wattmeter is connected to the low-voltage machine through other suitable transformers. The power-factor of the load of the wattmeter may be varied from unity to zero by rotating the field ring and poles of the generator connected to the current coil. Thus artificial loads of all power-factors can be readily obtained without excessive consumption of energy and with the greatest exactness. The points of zero and unity power-factor may readily be found by means of electrical testing instruments. The field ring is provided with a graduated scale, which moves past the zero mark on the end rings and give an indication of the angle of lead or lag.

This outfit was designed and manufactured by Roth Brothers & Company.



ROTH BROTHERS & COMPANY SPECIAL MOTOR-GENERATOR SET.

Large Railroads Adopt the Telephone for Train Dispatching.

The New York, New Haven & Hartford Railroad Company has placed orders for telephone and selector apparatus for equipping the Northampton Division for telephone train dispatching. The equipment consists of Gill standard bridging selectors and Western Electric telephone apparatus. This will be the first circuit so equipped on the New Haven road and covers a total of seventy-seven miles with twenty-nine stations.

The Atlantic Coast Line also has in process of construction, and will shortly cut into service, a telephone train-dispatching circuit from Richmond, Va., to South Rocky Mount, N. C., a distance of 121 miles. The dispatcher for this circuit will be located at Richmond. There will be thirty-two selector way stations and two local telephone stations in the chief dispatcher's office and the superintendent's office at Richmond. These stations will be called by means of a buzzer. Western Electric telephone apparatus and Gill selectors are used.

The rapidity with which the telephone is being adopted for train dispatching in some parts of the South emphasizes the progressive spirit with which the railroads of that section are meeting their problems today. The Western Electric Company reports that within the past six weeks three other railroads have placed orders for telephone train-dispatching circuits leading out of Richmond. These are the Chesapeake & Ohio, Richmond, Fredericksburg & Potomac, and the Seaboard Air Line.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, NOVEMBER 6.—A new type of locomotive is being constructed for the Caledonian Railway Company, and the experiment will be watched with great interest by railway managers. In this locomotive steam is generated in a boiler of the usual locomotive type, and is supplied to a turbine which in turn drives a direct-current dynamo. The turbine is of the impulse type and runs at 3,000 revolutions per minute. Current is supplied from the dynamo to the four series-wound traction motors at 600 volts. The motor armatures are mounted directly on the four main or driving axles of the locomotive. Very few details of the new locomotive are available or will be given by the makers, but it is stated that a switchboard, by which the motors can be connected in series, series-parallel, or parallel (according to the drawbar pull to be exerted), forms part of the equipment. The engine is intended for express passenger service.

The annual statement of the British Postmaster-General contains, as usual, interesting statistics as to the various public departments coming under the control of the Post-Office administration. New trunk telephone exchanges have been opened during the year to the extent of forty-seven, bringing the total up to 551, and it is interesting to see that trunk telephone conversations have increased by some seven per cent. New telephone subscribers to the Post-Office system are being connected at the rate of 150 per week, and the attempt to adapt existing telegraph wires for telephone purposes locally has been very successful. Contrary to the expressed opinions of the Marconi Company when the Berlin radio-telegraph convention was under discussion, it is stated that the effect of this has been distinctly to the advantage of the company's business. One hundred British merchant vessels are now fitted with wireless telegraph apparatus.

An instance of the manner in which several of our electric power companies have allowed their Parliamentary powers to become derelict, is to be seen in the Somerset and District Electric Power Company. This was authorized some five years ago and some commotion was caused in municipal circles by the fact that this was the first power company to be given authority to supply in towns already possessing a municipal electricity undertaking. Great things were expected in this connection, but the company has never been able to get on its feet for some reason, and within the past few months the Board of Trade has issued certificates of cesser of powers in the municipal areas mentioned. This cuts away the company's best area, or at any rate a good portion of it, and it would not be at all surprising if the undertaking were never started at all. There are three or four other power companies in the United Kingdom which have so far made no attempt to put their Parliamentary powers in operation, although they have been incorporated for several years.

Efforts are to be made to induce the Board of Trade to grant licenses to tramway authorities to employ the trackless-trolley system, so that the work may be proceeded with rapidly, instead of having to wait about twelve months as would be the case if a bill has to be promoted in Parliament specially for this purpose.

The obstinacy which the London County Council has hitherto shown in regard to the question of intercommunication with other tramway systems is at last giving way. Arrangements have been made with three municipal tramway authorities on the eastern borders of London for a through service over certain lines, an arrangement which has been asked for by the latter for a long time past. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, NOVEMBER 5.—One of the largest electric mine plants in France has recently been installed at the Portes et Senechas mines. The installation includes a large steam-operated electric station which is erected at the surface and near the mouth of the shafts, together with a cable drum hoisting apparatus placed within the horizontal shaft of the mine, and an extensive motor-driven pumping plant for pumping out the water. In the boiler room of the station seven boiler units of the Babcock & Wilcox and other types have been installed to supply the three main engines and alternator groups of the station. The power equipment consists of Collman engines of French make, one alternator built by the Siemens & Halske firm and two by the Allgemeine company. For the cable drums and pumping outfit three-phase motors are used, working on 1,000 volts.

In Holland, the commune of Gonda is taking measures to erect an electric plant for the local supply. The concession for a light and power station has been awarded to a Rotterdam company by the commune of Ooststellingswerf.

Successful results have been secured in Luxemburg by the Roechling-Rodenhausen electric process for steel, and the new furnaces which were installed recently have yielded a very good quality of product. The inventors are much encouraged by these results, especially as there is a good field for the steel process in this county, where iron ore is abundant.

An extensive telephone system for Corea is to be installed by the Japanese government in Corea. It is estimated that the enterprise will require an outlay of 70,000 yen.

The Swedish government is taking measures towards using electric traction on the Ofoten railroad line, which runs from the mining region of Kiruno to the Norwegian frontier. It is at present considering the propositions which have been made by two of the leading German electrical firms, each of which has formed a syndicate with Swedish companies in order to promote their projects. A decision will likely be made in the near future. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., NOVEMBER 13.—The electrical pumps, eighteen in number of the city of Toronto, will cost less than one-third of what was estimated by the city engineer of the waterworks. He counted upon an expenditure of about $150,000, while the contracts awarded amount to only $45,210.

Sir J. P. Whitney, premier of Ontario, denies that his recent visit to Ottawa was for the purpose of conferring with the Dominion authorities upon the validity of the Ontario acts regarding the hydroelectric power projects of the Ontario government passed last session. There has been a formal application for the disallowance of the acts on the ground that they are ultra vires of the local legislature. The federal authorities have until April to disallow the acts.

The civic light and power department of the city of Brockville, Ont., closed its fiscal year on September 30, and from the report just published, it is found that after paying the operating expenses, depreciation, debenture and interest, the net gain amounts to $864. The plant was purchased nine years ago, and since then gas and electric light have been reduced from $2 to $1.12 net, per 1,000.

Negotiations have been concluded for the location, at Welland, Ont., of a large steel plant where smelting will be done by electricity. The men behind the enterprise have large interests in steel and iron in the Pittsburg, Pa., section. The officers are: President, Tyson S. Dynes, St. Louis, Mo.; vice-president, George G. Gooderich, Saratoga, N. Y.; secretary, A. S. Ramage, Philadelphia, Pa. The last named designed the plant. Work will be begun at once on the billet mill, and 1,000 horsepower for the operation of the mill have been contracted for with the Falls Power Company. The daily output will be 1,000 tons, which will require 2,000 tons of ore daily, or a shipload per day. It is intended to erect, next year, other mills for the making of finished products in iron and steel.

One of the biggest deals in the history of the province of Quebec has just been completed by the forwarding to Ottawa of an application for letters patent to incorporate the Quebec Railway, Light, Heat & Power Company. The capital of the new concern is $10,000,000, and the companies taken into the merger are the Quebec Railway & Power Company, the Jacques Cartier Power Company, the Quebec Gas Company, the Frontenac Gas Company, the Canadian Electric Company, the Seven Falls Company, and several smaller concerns. The principal executive officer will be C. E. A. Carr, who thus becomes the manager of one of the biggest corporations in Canada. He was not long ago the manager of the Helena Light & Railway Company, of Helena, Montana. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

BIG PLANT ON THE TRUCKEE RIVER—It is reported that the Reno Power, Light and Water Company of Reno, Nev., will in a short time commence work on a $1,000,000 hydroelectric plant on the Truckee River. Most of the power generated will be transmitted to mining districts.

BIG PLANT ON FRENCH BROAD RIVER—The North Carolina Electric Power Company, subsidiary to the W. T. Weaver Power Company, it is announced, will shortly begin the construction of a mammoth power plant across the French Broad River near Marshall, N. C., west of Asheville. The plant will maintain an average horsepower of 4,600, the dam being thirty feet high and 500 in length, with 18,000 yards of concrete work in the construction. There will be two 2,200 horsepower generators, the completed plant representing some $400,000. This is the plant from which

it was stated power for the new electric line from Asheville to Galax, and tapping the new Carolina, Clinchfield & Ohio Railroad will be derived. Another site a few miles up the river offers further power if such shall be found to be required in the carrying out of the company's plant. The electric road will be known as the Asheville and East Tennessee Railway, with Galax as the terminus. L.

POWER PLANT FOR SALT LAKE—Water right has been granted to C. H. Roby for 615-acre feet of water to be obtained from North Dry Creek, and work on the power plant will start very soon. Four dams in all are to be constructed and the maximum amount of water to be drawn from the river for storage purposes will be 50-second feet. The plant, which is to be located just south of Little Cottonwood canyon will operate under a head of 2,145 feet and will develop 3,000 horse power.

NEW PLANT ON BROAD MOUNTAIN—The Lehigh Coal and Navigation Company is planning to erect a power plant near Tamaqua, Pa., which will rank in size with the hydro-electric plant at Niagara Falls. While a great part of the power will be secured from the river known as James Run, there will be auxiliary boilers and special grates. These grates are to be especially constructed to burn culm from the nearby mines. It is the promoter's idea to furnish power to Philadelphia, Baltimore and Washington.

MAMMOTH CONDUIT IN WEBER CANYON — The J. P. O'Neill Construction Company is constructing near Ogden, Utah, what is one of the largest pipe lines of its kind in the world. This conduit, which is a little over a mile long, is six feet in circumference, part being constructed of solid concrete, and the remainder of wooden staves bound with steel hoops. Water is to be conducted through this pipe from the storage reservoir to a power plant at the foot of the canyon. The entire plant, including the pipe will cost about $350,000 and will develop approximately 5,000 horse-power.

TO DAM THE AU SABLE—Preliminary work has been begun on the first big dam to be built on the Au Sable River by the Eastern Michigan Power Company. When completed, the water backed up by this dam will form a lake about six miles long and capable of generating 3,000 horsepower. According to the plans of the power company the construction of twelve more dams on the river will follow. Several of the eventual dams will generate singly more than twice the power of the one now under way. The entire utilization of the river's power will produce in excess of 50,000 horsepower or its equivalent in electrical energy.

LIGHTING AND POWER.

(Special Correspondence.)

FREMONT, NEB.—This city has completed the installation of a municipal lighting plant.

GRAND FORKS, N. D.—It is proposed to vote bonds for $25,000 to improve the electric-lighting system. P.

PALERMO, N. D.—The Village Trustees are considering the installation of an electric-lighting plant.

POTOMAC, VA.—The Alexandria Electric Company has been awarded the contract for lighting this city.

LEON, IOWA—The Leon Electric Company is erecting a new brick power house and installing new machinery. C.

WINNECONNE, WIS.—Business men propose to raise $5,000 for the construction of an electric line to Oshkosh. P.

DECATUR CITY, IOWA—Johnson & Smith have petitioned for a franchise to put in an electric-light and power plant. C.

SEBEKA, MINN.—John Konkler and N. S. Barbour have the contract for the installation of an electric-light plant here. P.

CENTRAL CITY, NEB.—Work on the new municipal lighting plant is being pushed and the lights will be turned on at an early date.

WELLINGTON, TEX.—The Wellington Water, Light and Ice Company has been incorporated, with a capital stock of $10,000. P

OELWEIN, IOWA—The Oelwein Light, Heat and Power Company will build a brick power house and make extensive improvements to its plant. C.

ST. LOUIS, MO.—The Laclede Gas Light Company contemplates the erection of an electric plant to supply office buildings and industrial plants with power. P.

SALEM, MASS.—The light plant of this city has been purchased by the Tenney Lighting Combination. The Tenney company controlls a number of other plants in the state.

EL DORADO, KAN.—Sharp Brothers, of this city, are making an estimate of cost for a power dam at Augusta, where S. J. Safford is about to get a fifty-year light franchise. P.

GALENA, KAN.—The Empire District Electric Company has filed notice with the secretary of state that it had paid up twenty per cent of its $6,000,000 capital and is now ready to begin work on its plant near here. Power is to be supplied to mines, mills and interurban lines, and is also to be supplied to several towns for street lighting.

TACOMA, WASH.—The survey for the city's $2,000,000 hydro-electric plant at Nisqually has been completed and it is expected that the construction work will be begun in a short time.

TORONTO, ONT.—The power house for the city's power distribution system is now under construction on Exhibition road. It is of absolutely fireproof construction, and will cost $36,000.

ABERDEEN, S. D.—The Aberdeen Electric Light and Power Company has been sold to the Union Company, of Omaha, Neb., and $100,000 will be expended for the installation of additional equipment and machinery. C.

BRISTOL, TENN.—The Bristol Gas and Electric Company has closed a contract with Eastern capitalists for the erection of a large power plant near here for the purpose of generating electricity for power purposes.

EVANS CITY, PA.—The Evans City Light, Heat and Power Company has been organized for the purpose of supplying the city with electricity for light, heat and power. A plant is to be installed in the near future.

WHITE BEAR, MINN.—The electric-light plant has been acquired by the Washington County Light and Power Company, of Stillwater, Minn., which will abandon the steam power house and furnish power from the plant at Stillwater. C.

CYNTHIANA, KY.—J. S. Johnston, superintendent of the Cynthiana Electric Light Company, is in the market for an "alternator, compound wound, 140 cycles, 1,100 volts, 200 to 250 kilowatts with exciter, and rheostat, all in first-class condition, and guaranteed."

NAPA, CAL.—The power line of the Napa Valley Electric Company will soon be completed and ready to furnish power to the towns of Napa, St. Helena, and Calistoga. The directors of the company are: Henry Brown, Percy S. King, G. S. Bonnor, H. J. Lewelling and D. L. Beard.

SODUS, N. Y.—The electric light system between Sodus and Ontario has been completed. The two plants in the villages named are now connected and either village can give the other light or power and either plant can take care of Williamson or East Williamson, or, if necessary supply of the entire system.

GREEN BAY, WIS.—The L. E. Myers Construction Company, of Chicago, has commenced putting up poles and surveying the line to convey the current from High Falls on the Peshtigo, operated by the Northern Hydro-Electric Company. Later the power will be transmitted to Two Rivers, Manitowoc and Oshkosh. C.

PHILADELPHIA, PA.—An ordinance has been passed providing for the erection of 171 additional electric arc lamps between Second and Sixteenth streets and similar bills are to be passed for lighting in other parts of the city. The total cost will be about $55,000. About $30,000 of this amount will be expended in providing ornamental posts and installing underground work.

TRENTON, N. J.—The Great Falls Power Company of Jersey City has been chartered with an authorized capital stock of $17,000,000. The purpose of the company is to acquire and deal in water rights and power, and to generate electrictiy for all purposes by waterpower. The stock is divided into $10,000,000 preferred and $7,000,000 common. The incorporators are W. C. Parker, L. J. Relyea and F. E. Griswold.

FERGUS FALLS, MINN.—This city has awarded the lighting contract to the Otter Tail Power Company. The contract, covering a period of seven and a half years, specifies a rate of two and one-half cents for the first 200,000 kilowatts, two and one-quarter cents for the second 200,000, and a flat two-cent rate for all amounts exceeding that. Electricity is to be delivered to the city's switchboard and distributed by them.

JOPLIN, MO.—The merger of the properties controlled by the Spring River Power Company and the Consolidated Light, Power and Ice Company has been completed in the organization of the Empire District Electric Company, incorporated in both Missouri and Kansas. The headquarters of the new corporation will remain at 414 Joplin Street, which has heretofore been occupied by the Consolidated company. The officers of the new corporation are: President, Henry L. Doherty, New York city; first vice-president, Frank W. Frueauff, New York city; second vice-president, A. E. Spencer, Joplin; secretary, David D. Hoag, Joplin; treasurer and general manager, M. R. Bump, Joplin.

CHARLOTTE, N. C.—An industrial policy which promises much for the western portion of the states of North and South Carolina, is said to have been definitely adopted by the Southern Power Company, namely, that of attracting large cotton mill and manufacturing plants to build factories at or near the several hydroelectric plants of the electric power company along the Catawba River in North and South Carolina. In this way it is proposed to induce many manufacturers to build plants along the banks of the river, where it is pointed out power can be supplied with the loss by transmission cut out, and at a very reasonable rate. The first plant thus organized is a $600,000 cotton

mill, which will be built near Great Falls, forty miles southwest from Charlotte, and in which Hal Mebane, Robert S. Mebane and others are interested. It is likewise understood that J. B. Duke, largely interested in the Southern Power Company, will be a stockholder in the new mill. This policy gives promise of numerous extensive developments along the Catawba River. L.

RICHMOND, VA.—It is reported that capitalists from Philadelphia contemplate building a double-track electric line, at least twenty-two miles in length, to connect Colonial Beach, a well-known resort, with the Richmond, Fredericksburg & Potomac Railroad. It is said that Quantico, being the nearest railway station to Colonial Beach, will likely be the terminus of the electric line. The estimated cost of the work is about $250,000. The power plant site will probably be at Classic Shore. A further report has it that the Widener-Elkins street-railway syndicate is behind this movement and that it is ultimately purposed to connect Richmond and Washington, D. C., by an electric line, several hundred miles in length. J. R. Benton, representing the parties interested, has already placed his petition for a franchise before the Town Council of Colonial Beach, and declared that the preliminary routes, costs, etc., had been considered and that the road would be built. L.

OROVILLE, CAL.—It is now given out that the Feather River Power and Development Company, which, under the name of H. O. Lague, recently filed an extensive water rights along the Middle Fork of the Feather River, is to erect three power plants, one on Fall River and two on Onion Creek. The first diversion of water from the Middle Fork of the Feather River will be at Nelson Point, where 15,000 inches will be diverted and carried eleven miles to the mouth of Onion Creek, where the water will be dropped 1,000 feet to the first power plant. From the first plant the water, increased to 20,000 inches, will be carried fourteen miles to a point near the mouth of the South Branch, where the water will be dropped 1,250 feet to the second power plant. From this point 25,000 inches of water will be ditched a distance of six miles to Fall River, where a fall of 720 feet to the third power plant will be available. It is claimed by the promoters that a total of 86,000 horsepower at low water can be developed at the three plants.

ELECTRIC RAILWAYS.

(Special Correspondence.)

IOWA CITY, IOWA—The Davenport and Iowa City Commercial clubs have pledged $400,000 toward the construction of an interurban line between the cities. C.

DAVENPORT, IOWA—The Davenport, Iowa City & Western Traction Company is planning the construction of an interurban line, fifty-three miles long, to Iowa City. C.

CHEHALIS, WASH.—The Twin City Light and Traction Company let the contract for grading on the electric line to Centralia to J. J. McCabe, of Portland, Ore. C.

POMONA, CAL.—The Trustees of Claremont have been asked to grant a franchise for the construction and maintenance of an electric street railway from Indian Hill through Claremont. A.

RENO, NEV.—Charles Burke and S. H. Wheeler have begun the work of building an electric line into the east end of the city. The line will run on South Virginia Street, Moran Street and Wheeler Avenue.

LA CROSSE, WIS.—The La Crosse Water Power Company has secured a franchise for the construction of an interurban line through Onalaska. The proposed route lies from there through Galesville and to Winona, Minn. C.

SEATTLE, WASH.—The Waterville Railway Company, of Waterville, Wash., has been organized and will build an electric railroad from Douglas Station on the new Great Northern extension to Waterville, a distance of five miles. The company is capitalized at $100,000. A.

IOWA CITY, IA.—The Davenport and Iowa City commercial clubs have pledged $400,000 preferred stock in a new company to use $1,500,000 in building an interurban line from Iowa City to Davenport. An effort is also being made to finance a line between Iowa City and Ottumwa.

CIUDAD PORFIRIO DIAZ, MEXICO—The proposition of building an electric railway from Ciudad Porfirio Diaz, state of Coahuila, to San Carlos, which is the headquarters of the 2,000,000-acre ranch and farm of General Lorenzo Trevino, is being promoted. It is claimed that the building of the road is practically assured. The Chamber of Commerce of Ciudad Porfirio Diaz is giving aid to the enterprise. The road will probably be largely financed by General Trevino.

ATLANTA, GA.—The Chattanooga Railway & Light Company, through its president, C. M. Clark, has filed a request for permission to issue $1,600,000 first mortgage and refunding bonds, and also to confirm an issue of $2,000,000 preferred and $3,000,000 common stock. The application is made in the state of Georgia because a part of the company's system is located in that state, and it is assumed that a general merger of those properties is contemplated. The application will be heard in Atlanta, November 9. L.

WASHINGTON, D. C.—Another step in the legal fight over street railways in New York City was recently taken when attorneys for the receivers for the Metropolitan Street Railway Company asked the Supreme Court of the United States to dismiss the appeal of the Guaranty Trust Company of New York. The decree, to which the appeal was made, ordered the foreclosure of a mortgage on the railway company. After the appeal had been denied by Judge Lacombe, it was allowed by Justice Peckham. The court has taken the subject under consideration.

TOLEDO, OHIO—The Detroit United Railway by the inauguration of a new fast limited train between Detroit and Saginaw has made it possible to go from Toledo to Saginaw Mich., a distance of 163 miles by trolley with only one change of cars. The change is made at Detroit. It is intimated that the D. U. R. will run limited cars through from Toledo to Saginaw next summer without change. From Detroit the route is by the way of the Flint division of the D. U. R. to Flint and over the Flint & Saginaw road to Saginaw. Port Huron and Jackson are among the Michigan cities reached by the new service. H.

SPOKANE, WASH.—Adolph F., Edward H. and Oswald N. Suksdorf, of Spokane, have incorporated the Columbia River & Mount Adams Railroad Company, with a capital of $2,000,000. The company has plans to build a railroad from a point on the Columbia River in Klickitat County, Wash., northerly through parts of Klickitat, Yakima and Skomania counties to a point in the vicinity of Mount Adams in the two latter counties. The company also plans to operate steamboats and ferries on the Columbia River and generate electric current for light and power purposes. Other enterprises contemplated will be to mine coal and handle timber.

ROCK HILL, S. C.—The Carolina Traction Company, of Rock Hill, has been chartered in South Carolina by W. S. Lee, Jr., manager of the Southern Power Company, Charlotte; George Stephens, president of the American Trust Company, Charlotte, and J. M. Cherry, real estate dealer, Rock Hill. The capitalization may be made $500,000. This company proposes to develop a system of rural trolley lines radiating from Rock Hill, and to build lines to Charlotte, twenty-five miles north, and to Lancaster, and to tap the Seaboard Air Line in Chester County. It is believed that power for the system will be obtained entirely from the Southern Power Company. L.

GUTHRIE, OKLA.—The St. Louis & Oklahoma Railway Company, with headquarters at Bromide, Coal County, and $50,000 capital stock, was chartered here today to build a line from Salisaw through Sequoyah, Haskell, Pittsburg, Coal, Johnson, Murray, Carter, Garvin, Stephens, Jackson and Greer counties to a point between the Red River and the Salt Fork of the Red River. The estimated length is 300 miles and the estimated cost of construction $15,000 per mile. The incorporators are: O. E. Snyder, Erie, Kan.; J. D. Cameron, Kansas City, Mo.; E. S. Brodie, St. Louis, Mo.; J. M. Sholl, Joplin, Mo.; E. T. Brown, Coalgate, Okla., and E. W. H. Jackson, Bromide, Okla.

SALT LAKE, UTAH—The San Francisco, Idaho & Montana Company, organized some time ago to build an electric line from Caldwell, Idaho, south to Jordan Valley, Ore., thence southwest via Duncan, and south to Winnemucca, Nev., is said to have been acquired by the Oregon Short Line. Grading has been finished on twenty miles, and track-laying will probably be finished this fall on this section, which carries the line to the Snake River, where a connection is to be made with the river extension of a new line to be built by the Oregon Short Line from Buhl, west to Nyssa. This new line avoids the two hills over which the operation of trains is difficult. It is probable that the new managers will build at an early date as far as Jordan Valley section, about sixty-six miles.

TOLEDO, OHIO—A strenuous effort is being made to finance the Findlay-Marion Railway and Light Company, so that the proposed road from Columbus to Toledo, planned before the financial depression, can be built. New York capitalists have been interested in the proposed line and it is said will send their engineer to Findlay, O., and if matters are found satisfactory it is declared that a construction company for carrying on the work will be immediately formed. The estimated cost of the work is $1,250,000 and the capital stock of the company stands at $250,000 but the claim is made that the capital stock will soon be increased to enough to cover the construction work. It is the intention to build the road over a private right of way. At a recent meeting interested capitalists and promoters were present from Findlay, Cleveland, Detroit, Marion and Columbus. H.

RICHMOND, VA.—On account of the near expiration of the time permitted within which to start work, and with the further report that the Virginia Railway & Power Company will not take over its franchise, the Richmond & Henrico Railway Company will be compelled to begin work immediately or to forfeit its franchise and the sum of $5,000 put up as a guarantee held

by the city of Richmond. A further report says that the first-named company has made several attempts to open negotiations for the purchase of the Richmond & Henrico Railway Company's franchise, but without results, and that the representatives of the new company have also been approached in New York. In view of the status of affairs, the street committee of the aldermanic body of Richmond is calling for the contract. The Carnegie Trust Company is named as the trustee for the company. The company may, however, take steps to retain its franchise. L.

NEW YORK, N. Y.—The New York Public Service Commission adopted a resolution, by a vote of three to two, modifying the Broadway-Lexington Avenue subway plan, so as to include a branch up the White Plains Road, from its junction with Westchester Avenue to the West Farms Road, where the new line will join Route 18, previously laid out, running from West Farms Road up White Plains Road to East Two-Hundred-and-Forty-first Street, near the New York city line. This change will give the Broadway-Lexington Avenue system three branches in the Bronx, instead of two, and the new route will develop the portion of the Bronx lying between the Jerome Avenue section, served by the River and Jerome Avenue branch, and the Westchester Avenue section, which will be served by the Pelham Bay Park branch. The new line will be five miles long and add about $4,000,000 to the estimate of $60,000,000 for the Broadway-Lexington Avenue line. In addition, there is $7,000,000 cost for the Canal Street crosstown section.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

STANHOPE, IOWA—The Stanhope and Northwestern Telephone Company has been incorporated. P.

LYONS, NEB.—The Burt County Telephone Company has been incorporated with a capital stock of $100,000. P.

VERGAS, MINN.—The Vergas Telephone Company has been incorporated, with a capital stock of $10,000. P.

SEDAN, OKLA.—The Saddle Mountain Mutual Telephone Company has been incorporated with a capital stock of $875. P.

PAXTON, NEB.—The Paxton and Sutherland Telephone Company has been incorporated with a capital stock of $5,000. P.

BUCK CREEK, IND.—The Eckert Telephone Company is in the market for a new switchboard to replace the equipment recently destroyed by fire. J. C. Eckert is president of the company. S.

SOUTH BEND, IND.—The Central Union Telephone Company has been authorized to proceed with the installation of its conduit system. The company's new exchange building is almost completed. S.

FT. WAYNE, IND.—The officials of the Home Telephone and Telegraph Company announces that $4,000 worth of new equipment will be installed in the South Branch stations. The harmonic system will then be established. S.

GESSIE, IND.—The Citizens' Telephone Company has incorporated to build and equip an exchange and telephone system in Gessie and throughout the western portion of Vermilion County. The capital stock is $3,000. The directors are: A. R. Peterson, A. W. Banks, W. F. Clem and F. L. Vawter. S.

ROCKY MOUNT, N. C.—The Home Telephone Company has perfected plans for extensions through Nash and Wilson counties, reaching out to the exchange at Spring Hope, Bunn, and numerous other points. General Manager F. C. Toppleman, of Henderson, is superintending a large part of this work of extension. L.

TEAGARDEN, IND.—The St. Joseph County Mutual Telephone Company has filed articles of incorporation and is now in the market for material to build and equip a telephone system in Teagarden and extend the lines throughout St. Joseph County. W. C. Divine, C. F. Ruple, J. S. Davis and Frank Retter constitute the board of directors. S.

ALBANY, N. Y.—The Citizens' Home Telephone Company, of Walton, Delaware County, has been incorporated with a capital of $100,000. The company is to operate in the counties of Delaware, Broome, Otsego, Chenango, Green, Schoharie, Ulster and Sullivan. The directors include George O. Mead, of Walton; Theodore M. Brush and Irving H. Griswold, of Elyria, Ohio; Irving R. Coughley and George H. Rymers, of Albany.

ALBANY, N. Y.—The Cattaraugus Union Telephone Company has been incorporated, with a capital of $50,000, to operate in the counties of Niagara, Erie, Chautauqua, Cattaraugus, Orleans, Genesee, Wyoming, Allegany, Livingston, Steuben and Monroe. The directors are Charles M. Beattie, William T. Farrell, W. Roy McCanne, John W. Morrison, Jr., Fred C. Goodwin, Fletcher W. Peck and George R. Fuller, of Rochester.

BUTTE, MONT.—Incorporation articles of the Interstate Consolidated Telephone Company have been filed here. The company is capitalized at $5,000,000, and already has acquired the Home Telephone Company in Spokane. It will operate through the Northwest, taking over the Independent Telephone Company of Montana. The new corporation is backed by capitalists of San Francisco, Los Angeles, Spokane, Portland, Butte and Missoula.

CHICAGO, ILL.—The recent dispute between the city of Chicago and the Chicago Telephone Company has been ended by a payment of $17,282.57 to the city. According to the ordinance, the company was to pay the city three per cent of its gross earnings. The company held that revenue from real estate, construction work done for others, etc., should not be included. These amounts total $576,085.63 and are all covered by the company's payment.

FREDERICK, MD.—The Frederick County Telephone and Telegraph Company, operating a system covering Frederick County with 1,525 subscribers and having long-distance connections, will be absorbed by the Chesapeake and Potomac Telephone Company, of the Bell system, the deal for its purchase having just been closed. The purchasing company acquires the stock and bonds of the local concern at a price said to be in the neighborhood of $125,000.

PEORIA, ILL.—The telegraph companies have been given until the 12th of December to place their wires underground. This is in accordance with the ordinance passed by the Council, which calls for the completion of the work by that time. With the placing of these wires underground the streets in the downtown district will be cleared of all wires overhead, as the lighting company and the telephone companies have their wires underground now or will soon have them so. V.

TOLEDO, O.—Suit has been filed by Herman C. Stifel, a broker, of St. Louis, against the Toledo Home Telephone Company, to require the company to set a date upon which he may examine the books. The petition states that Stifel is a stockholder and that the company, upon proper demand, refused recently to permit him to make such an inspection. He also asks that the company be enjoined from removing the books from the jurisdiction of the court. A similar petition was filed by Mr. Stifel against the New Long-Distance Telephone Company of Indianapolis, Ind.

COVINGTON, KY.—United States District Judge Cochran handed down a decree which directs a special master to sell the plant of the Central Home Telephone Company, of Wilmington, Del., to foreclose a mortgage held by Judge John M. Lassing, of the Kentucky Court of Appeals. Judge Lassing claims that the company fraudulently delivered to its president $550,000 worth of bonds as collateral security on an indebtedness of less than $50,000. It is declared the president wrongfully converted the bonds to his own use, and has failed to account for them, which it is alleged has made the concern insolvent. Judge Lassing also alleged that the company was indebted to him $8,000, which he paid for it as security on notes, and for which he had a mortgage.

NEW YORK, N. Y.—Officers of the Continental Telephone Company, a recently incorporated independent concern, with an authorized capital of $50,000,000, announce the purchase of the property of the Independent Union Telephone and Telegraph Company, which operates telephone lines in a territory reaching from Newburgh, N. Y., on the east, to Erie, Pa., on the west. The new owners announce that they will put the property into shape to handle telegraph as well as telephone business. The Continental company announces that it expects to take in several other independent lines between New York and Omaha, and plans to handle telegraph as well as telephone business over all its long-distance wires. Capitalists from St. Louis, Wheeling, Pittsburg and New York are said to be backing the enterprise.

NEW INDUSTRIAL COMPANIES.

LORAINE, OHIO—The Marine Electrical Company has been incorporated with a capital of $25,000. Electrical steamship appliances and devices will be the principal articles manufactured.

NEWARK, N. J.—The Electric Economy Company, mechanical and electrical engineers, has incorporated with a capital of $25,000. The incorporators are Louis Froelich, James O. Sharp and Arthur S. Randolph, all of Newark.

CHICAGO, ILL.—The Charter Electric Company has been incorporated, with a capital of $250,000, to manufacture, sell and install electrical appliances. The incorporators are: G. C. Cummings, J. A. Kick and A. Wray.

PROVIDENCE, R. I.—The Barnes and Loud Electric Company of 57 Weybosset Street, has filed articles of incorporation with the Secretary of State. The incorporators are Bradbury L. Barnes, Harry M. Paine and Harry B. Loud. The capital stock is $5,000.

NEW YORK, N. Y.—The Acme Gas and Electric Fixture Company has been incorporated to manufacture electric fixtures, gas and electric appliances, etc., with a capital of $30,000. The incorporators are: S. Wallach, S. H. Shiminsky, New York city, and H. L. Adelman, Brooklyn.

ELECTRICAL SECURITIES.

While the trend of the market has been, in general, good during the past week there has been a marked speculative tendency. The effect of this has been, in a number of cases, to produce a decrease in the value of securities and in others to cause a marked increase. Such a condition must occur from time to time, but does not in any way effect the gradual increase of values and the resumption of business.

On account of a special meeting of the stockholders of the Pacific Coast Power Company, to be held December 20, the transfer books will be closed from December 6 to December 20, inclusive.

The Chicago Blue Island & Joliet Traction Company has borrowed $500,000 from the American Trust & Savings of Chicago on forty-year, five-per-cent bonds.

Chicago Railways Company show an increase of gross-earnings in the first nine days November of $47,000, equal to seventeen per cent. It is safe to say that earnings for the fiscal year will be over $12,500,000, placing the Chicago Railways Company in the first rank of Chicago public utility corporations.

The Chicago Telephone Company has paid the city $17,282, representing three per cent due the city on $576,085, the gross receipts from odd sources. The matter was in dispute for two years.

Stockholders of the Commonwealth-Edison Company, Chicago, have authorized the $10,000,000 increase in the capital stock, from $30,000,000 to $40,000,000. Directors of the Commonwealth-Edison Company have re-elected officers.

At the annual meeting of the Manhattan Railway Company, Kingdon Gould was elected a director, to fill the place of General Thomas T. Eckert, resigned. Other directors and members of the executive committee were re-elected. The directors of the Manhattan Railway Company have re-elected the officers.

At the special meeting of the Electrical Securities Corporation it was voted that the number of directors be decreased from twenty-three to twenty-one. At the annual meeting of the stockholders S. L. Eldridge and G. M. Cumming were dropped from the directors and the other directors were re-elected.

For the current fiscal year, which began October 1, charges and dividends of Boston Elevated will be about $300,000 greater than for the twelve months just ended. This is made up of eight months' dividend at the rate of six per cent on $6,550,000, and three per cent. interest on seventy-five per cent. paid stock for about four months, or October to January 25.

In conformity with the new law passed last year authorizing public service corporations to fix a price at which they desire to issue additional shares, the directors of the Edison Electric Illuminating Company of Boston have fixed a price of $215 a share on the proposed issue of 19,452 new shares. The amount of shares to be issued and the price must receive the approval of the Gas Commission before the offer to stockholders for subscription.

Gross earnings of the American Telephone and Telegraph system for the year to end the last of next month, will total slightly more than $150,000,000, compared with $140,000,000 in 1908 and $125,000,000 in 1906, a gain of twenty per cent. in three years.

DIVIDENDS.

American Railways Company; quarterly dividend of one and one-half per cent, payable December 15.

Kings County Electric Light and Power Company; quarterly dividend of two per cent, payable December 1.

Mobile Electric Company; quarterly dividend of one and one-half per cent on preferred, payable November 16.

NEW YORK.

	Nov. 15.	Nov. 8.
Allis-Chalmers common	15	15¾
Allis-Chalmers preferred	53½	53⅞
Amalgamated Copper	90⅞	87¼
American Tel. & Cable	80*	80*
American Tel. & Tel.	141¾	141½
Brooklyn Rapid Transit	75¾	76
General Electric	162	163
Interborough-Meropolitan common	22⅞	19¾
Interborough-Metropolitan preferred	54¾	49⅜
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common.	92¼	93¾
Mackay Companies (Postal Telegraph and Cables) preferred	75⅞	75½
Manhattan Elevated	140	141
Metropolitan Street Railway	25	23
New York & New Jersey Telephone	123½	123½
U. S. Steel common	90⅜	91⅝
U. S. Steel preferred	126	126¾
Western Union	79	78
Westinghouse common	85	86⅝
Westinghouse preferred	135	140

*Last price quoted.

BOSTON.

	Nov. 15.	Nov. 8.
American Tel. & Tel.	141¾	141
Edison Elec. Illuminating	...	...
General Electric	162	163
Massachusetts Electric common	15¾	18½
Massachusetts Electric preferred	...	82⅜
New England Telephone	134	134
Western Tel. & Tel. common	11¼	10½
Western Tel. & Tel. preferred	88	88

PHILADELPHIA.

	Nov. 15.	Nov. 8.
American Railways	45¼	45¼
Electric Company of America	12⅛	12¼
Electric Storage Battery common	59	58½
Electric Storage Batterp preferred	59	58½
Philadelphia Electric	13½	13⅛
Philadelphia Rapid Transit	26¾	27½
Philadelphia Traction	89	89
Union Traction	52¾	53½

CHICAGO.

	Nov. 15.	Nov. 8.
Chicago Railways, Series 1	104	104
Chicago Railways, Series 2	33¼	34
Chicago Subway	6¾	7
Chicago Telephone	136	136
Commonwealth Edison	119	119
Metropolitan Elevated common	16½	17
Metropolitan Elevated preferred	52	54
National Carbon common	96½	95¾
National Carbon preferred	118½	118¼

PERSONAL MENTION.

H. C. RICE, vice-president of the General Incandescent Lamp Company, of Cleveland, Ohio, arrived in San Francisco from Los Angeles last week. A.

GEORGE W. WOOTEN, of Salt Lake City, has resigned his position as assistant secretary of the Rocky Mountain Bell Telephone Company, on account of the health of his family. Mr. Wooten has accepted a position in Chicago.

ERNST J. BERG, who has for the past seventeen years been associated with the General Electric Company of Schenectady, N. Y., has recently been appointed professor of electrical engineering in the University of Illinois at Urbana, Ill. Mr. Berg succeeds Professor Morgan Brooks, who is now absent on leave of absence.

EDWARD BENNETT, of Jeanette, Pa., has recently been appointed associate professor of electrical engineering at the University of Wisconsin. Professor Bennett is a graduate of Western University of Pennsylvania, now the University of Pittsburg. He was recently located at Telluride Institute in Utah, where he did research work for the Telluride Power Company and assisted in the instructional work of the institute. He has also been with the National Electrical Signal Company in wireless work, and the Nernst Lamp Company. M.

C. S. GLEED.

CHARLES S. GLEED of Kansas City, Mo., president of the Missouri and Kansas Telephone Company, has recently been elected president of the Bell Telephone Company of Missouri. Mr. Gleed has for a number of years been prominent in public life in both Missouri and Kansas, being director of several railroads and banking companies. Mr. Gleed has also been a trustee of Kansas University for a number of years and is the author of many legal and political articles.

B. F. O'MARA, general superintendent of the eastern division of the Michigan United Railway Company, has taken charge of the Kalamazoo city lines of that company.

W. E. SHARP was elected president of the Lincoln Traction Company at a recent meeting of the stockholders. A transfer of stock took place before this election, but the new stockholders intend to carry out the scheme of sharing profits with the city.

J. L. MILLSPAUGH, the general superintendent of the western division of the Michigan United Railway Company, has been put in charge of the Lansing-Jackson line. Mr. Millspaugh will also act as assistant to General Manager Clark in the work at Jackson.

GEORGE A. McKINLOCK, president of the Central Electric Company, and Mrs. McKinlock have been visitors in New York and Boston for the past week. They both attended the school football game, in which their son, Alexander McKinlock, won the highest honors.

MILLIDGE G. SWETT, Calais, Me., for several years a section manager for the New England Telephone Company, severed his connection with that company November 1. Joseph Broadbent, formerly, solicitor for the company has been appointed as manager for the present.

A. L. OAKES, of Newport, Me., who has been manager of the Bangor division of the New England Telephone and Telegraph Company, for the past three years, has been promoted to the position of special agent for District Manager Emerson and will enter upon his duties at once.

C. E. ALLEN has just joined the selling force of the Westinghouse Electric and Manufacturing Company in connection with the sales of transformers. Mr. Allen was formerly connected with

the General Electric Company in a similar capacity, but resigned from that company during the past summer.

MARSHALL B. DOWNING, who has for some time been manager of several of the New York Telephone Company's exchanges in New York city, has recently been promoted to position of district superintendent. The district which Mr. Downing now has, includes Albany, Troy and several other up-state cities.

CHARLES L. EDGAR, of Boston, and W. C. L. EGLIN, of Philadelphia, both past-presidents of the National Electric Light Association, were recent visitors to New York, conferring on electric lighting problems. Both report the constant growth of their companies and an increased demand for electric current for illuminating and power purposes.

ARTHUR J. SWEET will leave the Westinghouse Lamp Company on December 1 to join the engineering department of the Holophane Company. In his new position, Mr. Sweet will have charge of important new development work which the Holophane Company has long planned to undertake along the line of special globes and reflectors for classes of service not heretofore covered by the Holophane products. Mr. Sweet is a graduate of Cornell University and satisfactorily completed three of the four years' course in electrical engineering at Massachusetts Institute of Technology. After a shop apprenticeship course, he spent three years with the Westinghouse Electric and Manufacturing Company, nine months with the Western Electric Company and about two years and a half with the Westinghouse Lamp Company. His work throughout has been along lines of practical and theoretical development. In the lamp works he gained an intimate knowledge of photometric methods and equipment, and did considerable work in illumination design. He has written several papers that were presented before engineering societies and a number of articles for technical journals.

A. J. SWEET.

W. P. CARSTARPHEN, of the Carstarphen Electrical Company, Denver, Colo., it is announced in a recent issue of The Denver Post, will about the beginning of January next, begin the erection of a four-story building for a new electrical plant to include departments for electrical manufacturing, chemical manufacturing, wiring and construction, merchandise, etc. The roof of the new building, it is stated, will have a specially constructed landing, of large proportions, for aerial craft. This will be the first of its kind constructed in the West and will be very similar to the aviation station designed for the roof of the twelve-story club building of the Automobile Club in New York city.

OBITUARY.

GEORGE WILLIAM HOFFMAN, of Indianapolis, Ind., manufacturer of United States metal polish and other similar specialties, died at his home on Friday, October 22, after a short illness. His departure is greatly regretted by his many friends. The business, it is understood, will be continued by his relict on the same lines as formerly.

GEORGE F. DURANT, who died suddenly at Boulder, Colo., a short time ago, was recognized everywhere as one who has not only been of great assistance to telephone development of late years, but was one of the first to see the possibilities of the exchange system and to attempt to install an exchange. In 1877, when Mr. Durant was local manager of the American District Telegraph Company, he conceived the idea of giving St. Louis a telephone system and interested his company in financing the scheme. It was his idea that after a hundred subscribers were secured the telephone business would begin to be profitable. Rates were then about $150 per year. Mr. Durant's activities were not confined to this country alone, but as the representative of the American District Telegraph Company he was the pioneer in the establishment of lines in Chili, Argentine Republic and Brazil. Mr. Durant was president of the Missouri Cremation Society, vice-president of the Lakeside Sugar Refinery Company and a director of the Lincoln Trust Company. He was a member of the Mercantile and Union clubs of St. Louis. At the time of his death he was general manager of the Bell Telephone Company of Missouri.

NEW PUBLICATIONS.

EDISON LIFE—The Edison Employees' Club, of the Edison Electric Illuminating Company, of Boston, has issued the first regular number of its new monthly, "Edison Life." This title was chosen as a result of a contest in which Harry B. Knights received the prize for the most appropriate name. This monthly will be devoted to both the business and social interests of the Boston Edison employes, and in this November issue contains a great many interesting facts relative to the generating department, as well as to the doings of the club.

THE GENERATOR—The October number of The Generator, a publication issued by the students of the New York Electrical School, has recently been distributed. It contains several articles of merit and also many interesting school notes.

COALING, DOCKING, AND REPAIRING FACILITIES OF THE PORTS OF THE WORLD—The fifth edition of this useful publication has recently been issued by the Office of Naval Intelligence (Washington, Government Printing Office, 1909).

YALE SCIENTIFIC MONTHLY—The October issue of this monthly magazine contains a very interesting account of the recent Aviation Week at Rheims. Among the other articles, one especially worthy of note is that by John T. Stevens, on "The Relation of Railways to Canals."

THE UTILIZATION OF FUEL IN LOCOMOTIVE PRACTICE.—This is the title of Bulletin No. 402, of the United States Geological Survey, edited by Prof. W. F. M. Goss, of the Technologic Branch of the Survey. The statement is made that locomotives in this country are responsible for more than one-fifth of the total coal production in the United States, and the tests detailed in the bulletin were made with a view to economy in this direction.

FUEL TESTS WITH ILLINOIS COAL.—This publication is issued as Circular No. 3 of the Engineering Experiment Station of the University of Illinois, Urbana, Ill., and presents the results of an elaborate series of tests conducted at the fuel testing plant of the United States Geological Survey. The circular is compiled by L. P. Breckenridge and Paul Diserens. It deals only with coals taken from mines within the state of Illinois. The investigations described include steaming tests under boilers, gas producer tests, washing tests, coking tests, briquetting tests, and tests to determine composition and heating value. From the results stated it appears (1) that the average calorific value of Illinois coal (ash and moisture free) is 14,319 British thermal units; (2) that its evaporative efficiency is but slightly affected by the moisture it contains; (3) that its evaporative efficiency decreases as the ash and sulphur content increases, and that when burned in a hand-fired furnace its evaporative efficiency decreases as the amount of fine coal contained in it increases; (4) the performance of Illinois coal in a gas producer compares favorably with that of any other bituminous coal tested at the United States Geological Survey laboratory; (5) one-fourth of all the samples tested may be used for the manufacture of coke; (6) briquetting improves the evaporative efficiency of Illinois coals only when the raw coal is in the form of slack or screenings. Complimentary copies of the circular may be obtained on application to W. F. M. Goss, director of the Engineering Experiment Station, at the University.

EDUCATIONAL NOTES.

CHICAGO TECHNICAL AND CONTINUATION HIGH SCHOOLS—The Board of Education, of the city of Chicago, has issued in pamphlet form its announcement of free evening courses in the technical and continuation high schools that have recently been established. The work comprises free English and commercial courses at the Hoyne School, and similar courses combined with technical studies at the Crane Technical High School, the Lake High School and the Lane Technical High School. These latter courses are of considerable interest, as they include, besides manual training and drawing, a fairly good introduction to the applied sciences, the principles of electrical and mechanical engineering, applied mathematics, English and modern languages.

NEW YORK UNIVERSITY, DEPARTMENT OF JOURNALISM—A very fitting recognition of the growing importance of trade papers has just been given by New York University in the inauguration of a department of journalism in the School of Commerce, Accounts and Finance. "Trade and financial journals," says the official announcement of the department, "have become within recent years a powerful force in business life. There still remain great opportunities for expansion and improvement, and a career in this field should appeal strongly to persons who possess ability and the right kind of training. It is believed that the School of Commerce, Accounts and Finance, in connection with the Department of Journalism, can now offer a remarkable comprehensive and efficient training for such work." There is hardly a business man who does not scan his trade journal more closely than he does his newspaper. This new department, established by one of the prominent educational institutions of the country, will undoubtedly help to their further development. Up to this present time adequate preparation for work on such publications has not been easily obtained. It is peculiarly fitting that New York University should be the first to give this deserved recognition, for its School of Commerce, Accounts and Finance has already established a reputation for giving practical education.

PROPOSALS.

POST OFFICE AND COURT HOUSE, COUNCIL BLUFFS, IOWA—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until November 26 for a lighting and conduit system at the United States Post Office and Court House and extension thereto at Council Bluffs, Iowa, in accordance with drawings and specifications, copies of which may be had at this office, or at the Supervising Architect's office.

POST OFFICE, NEW LONDON, CONN.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until November 30 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, etc., to the United States Post Office at New London, Conn., in accordance with drawings and specification, copies of which may be obtained from the custodian at New London, Conn., or at the Supervising Architect's office.

NEW BRUNSWICK, N. J.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until December 2 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension and remodeling of the United States Post Office at New Brunswick, N. J., in accordance with the drawings and specifications, copies of which may be obtained from the custodian at New Brunswick, N. J., or at the Supervising Architect's office.

POST OFFICE, HOT SPRINGS, ARK.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until December 6, 1909, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the United States Post Office at Hot Springs, Ark., in accordance with the drawings and specification, copies of which may be obtained from the custodian at Hot Springs, Ark., or at the office of the Supervising Architect.

POST OFFICE AND COURT HOUSE, DAVENPORT, IOWA—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until December 15, 1909, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the United States Post Office and Court House, Davenport, Iowa, in accordance with drawings and specifications, copies of which may be obtained from the custodian at Davenport, Iowa, or at the Supervising Architect's office.

POST OFFICE AND COURT HOUSE, MONTGOMERY, ALA.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until November 24 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the United States Court House, Post Office, etc., at Montgomery, Ala., in accordance with drawings and specifications, copies of which may be obtained from the custodian at Montgomery, Ala., or at the Supervising Architect's office.

POWER PLANT FOR CUSTOM HOUSE, SAN FRANCISCO, CAL.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until December 18, 1909, for power plant, including boilers, engines, electric generators, switchboard, conduits, wiring, heating and ventilating apparatus, deep well, deep well pumps and vacuum cleaning system, for the United States Custom House and Appraisers' Stores buildings at San Francisco, Cal., in accordance with drawings and specification, copies of which may be obtained at the office of the Supervising Architect, or at the office of the architects, Messrs. Eames & Young, Wright Building, St. Louis, Mo. Applications must be accompanied by a certified check for $100, drawn to the order of the Treasurer of the United States, the proceeds of which will be held in this office until the return of the drawings and specifications.

LEGAL NOTES.

FAILURE TO COMPLY WITH ORDINANCE REQUIREMENTS NEGLIGENCE—Where the ordinances of a city require an electric-light company to maintain its electric-light wires in a taut condition to avoid swinging contacts, and to keep such wires properly insulated, and, wherever it is necessary for such electric-light wires to cross the line of a telegraph or telephone line, to string its said wires at a distance of not less than five feet from the wires of said telegraph or telephone line, the Supreme Court of Nebraska holds, Olson vs. Nebraska Telephone Company, that a failure on the part of said electric-light company to comply with all or any of such requirements is negligence which will render it liable to any person who, without fault on his part, is injured by reason thereof.

LIABILITY OF DISTRIBUTOR OF ELECTRICITY ON WIRES OWNED BY OTHERS—A distributor of such a deadly agency as electricity, the Court of Appeals of Kentucky says, in Lewis' Administrator vs. Bowling Green Gaslight Company, cannot escape liability for negligence in the manner of distribution by turning it onto private wires, or on the wires of another concern, which are not safely arranged to receive and transmit the current. Nor can it dispense with the duty of inspecting the wires, from time to time, to see that they are securely fastened and properly insulated, although the lines are not owned by it. When it uses the lines, it is its duty to see to their proper and safe condition. This duty is not discharged by the exercise of ordinary care, but requires the highest degree of care to keep them safe.

PUBLIC USE FOR ELECTRICITY—In a case where a corporation organized under the laws of the State of Washington for the purpose of generating and transmitting electrical current and electrical power for uses claimed to be public within the purview of the state constitution was seeking to condemn and appropriate certain waters, the Supreme Court of Washington holds, State vs. Superior Court, that so much of the electricity as was destined to be used for public and municipal lighting and in the operation of common carrying railroads, whether directly through the corporation or indirectly through its assignees or successors, was for a public use. The fact that the company would sell and deliver a portion of its electrical power to third persons and corporations, to be by them used for public and municipal lighting and in the operation of railroads, would not afford a sufficient reason for denying to it the right of eminent domain.

WHAT IS TAXABLE AS GROSS EARNINGS OF A TELEPHONE COMPANY—In State vs. Northwestern Telephone Exchange Company, the Supreme Court of Minnesota holds that a proportionate part of the earnings of the property of telephone companies within that state, resulting from its use in interstate commerce, constitute a part of its gross earnings, upon which it must pay the three-per-cent tax provided for by the general laws of 1897. Money received from messengers not regularly in the company's service, but employed specially to call non-subscribers to the telephone stations, and money collected from the company's patrons and subscribers as messenger charges actually paid to persons in whose buildings the company's booths are located, and as compensation for such location, are a part of the gross earnings. But money collected by a telephone company from its patrons and subscribers for other telephone companies, with which it has traffic arrangements, is not a part of its gross earnings. And the amounts which the regular rates would have produced, had the service, which was in fact rendered without charge, been charged for at the regular rates, is not a part of the gross earnings.

RIGHT OF ELECTRIC ROADS TO CROSS STEAM RAILROADS—In an opinion handed down in the Fourth Court of Civil Appeals at San Antonio, Tex., Associate Justice W. S. Fly handed a decisive blow to efforts of steam railroads to block competition from electric lines. The case in point was that of the Galveston, Harrisburg & San Antonio Railroad Company vs. the Houston Electric Company, on appeal from Harris County. The appellant sought to restrain the traction company of Houston from building a suburban line across its tracks. In the lower court a writ of injunction was secured, but it was later set aside. The decision was affirmed. In giving his opinion, Judge Fly said: "No additional burden will devolve upon appellant by the crossing constructed by appellee, and it has acquired no right by being authorized to cross the public road as would empower it to stop the wheels of progress and thwart the efforts of the public to obtain better and faster transportation. It has been held time and again in this state and others that no new burden or servitude is imposed upon a public street or highway by constructing and operating a street railway thereon where cars are propelled by electricity in the transportation of passengers."

PRIMA FACIE LIABILITY FOR INJURY FROM HANGING OR FALLEN WIRE IN STREET—In view of the dangerous character of electric-light and power wires, and the peril to which their suspension over the public streets exposes the public who constantly traverse and use the streets, the Court of Appeals of Maryland thinks it both just and reasonable to hold that the injury of a person upon the surface of the street by contact with a hanging or fallen wire of that character, in itself, if unexplained, affords sufficient prima-facie evidence of negligence on the part of the owner of the wire to entitle the plaintiff to go to the jury in an action for damages for the injury. In the case before the court, Walter vs. Baltimore Electric Company, 71 Atlantic Reporter, 953, there was evidence that, as the plaintiff, a boy eight years old, was passing along a public street he swung himself around a pole standing in the pavement, when he came in contact with a hanging wire charged with electricity, and badly burned his head and his hand. The evidence did not show the existence of any sudden or unforeseen cause for the falling of the wire, nor show with certainty whether it fell before or at the time of its coming in contact with the boy. The court is of the opinion that the evidence was sufficient to raise such a prima facie presumption of negligence against the company as to call for an explanation from it, and therefore sufficient to carry the case to the jury, though, of course, the company should be permitted to rebut the presumption of negligence, and show by any lawful evidence, if it could do so, that it had fully discharged its duty to the public in the erection and maintenance of its wires.

INDUSTRIAL ITEMS.

C. H. HUGHES AND COMPANY, formerly of 120 Broadway, have moved to the United States Realty Building, 115 Broadway, New York.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY has commenced work on 130 200-horsepower motors for the Long Island Railroad.

THE STAR EXPANSION BOLT COMPANY, New York, N. Y., makers of the Star expansion bolts, has moved its New Orleans, La., sales office to 504 Audubon Building, where strangers and friends alike will be welcomed by D. S. Miller.

THE F. W. WAKEFIELD BRASS COMPANY, Vermilion, Ohio, is distributing an illustrated price list of electroliers. This list is devoted particularly to the new square fixture and contains a number of illustrations of this type, affording the recipient a large variety to select from.

THE DUPLEX METALS COMPANY, New York, N. Y., is distributing an attractive catalogue devoted to an explanation of the many uses of copper-clad steel wire and giving some useful data. This company is also distributing a circular entitled, "Is Copper-Clad Steel Wire An Experiment?" This circular presents some interesting figures.

THE RAPID MOTOR VEHICLE COMPANY, Pontiac, Mich., is increasing the capacity of its plant to meet the growth in its business. The new electrical equipment which is to be furnished by Allis-Chalmers Company, will consist of two 600-kilowatt generating units. The generators are 240 volts, sixty-cycle, three-phase machines directly connected to cross-compound-condensing engines.

THE TRUMP MANUFACTURING COMPANY, Springfield, Ohio, manufacturers of water wheels, transmission machinery, etc., is distributing a catalogue devoted to Trump Turbines for low and medium heads and also to scroll type turbines for head ranging from fifty to 300 feet. This publication contains views and diagrams of all parts of these machines in addition to concise descriptions, tables and data.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is distributing the November number of its regular publication. This issue contains several good descriptions of new apparatus, among which may be named: "Electric Forge Blowers," and "The Elmo Washing Machine," also useful information and data. In addition this number contains an instructive editorial entitled "Sincerity in Business."

PETTINGELL-ANDREWS COMPANY, Boston, Mass., dealers in electrical merchandise, has recently distributed the November issue of its publication, entitled "Juice." This number contains articles which should be of interest to the trade generally, prominent among which may be named, "According to Schedule" and the editorial, "Team Work." These articles embody excellent suggestions for business of all kinds, but particularly the electrical industry.

THE MARION STEAM SHOVEL COMPANY, Marion, Ohio, is now building a second electric shovel for the Casparis Stone Company and has placed an order with Allis-Chalmers Company for the necessary electrical apparatus. It will include two seventy-five horsepower series wound direct-current motors of the railway type and one 150-horsepower composite motor, with the necessary controlling devices. Something over a year ago the Marion Company built the first electric shovel for this customer and its success has been extremely marked. The new machine will be practically a duplicate of the first.

THE ALLIS-CHALMERS COMPANY has recently sold a gas-engine generator set to T. F. Fulkerson of Sapulpa, Okla. The engine is of the standard four-cycle double-acting tandem. It is rated at 360 horsepower when making 200 revolutions per minute and will operate on natural gas from the Oklahoma belt. The frame and slide are cast in one piece, which is extremely heavy, as are all the essential parts of the machine. The generator, which is direct-connected to the engine, is a sixty-cycle, three-phase, 2,300-volt machine. The exciter is belted to the generator and develops 120 volts. In addition to this the Allis-Chalmers Company has also just received an order for two 300-kilowatt, direct-current, engine-type generators and nineteen direct-current motors, which are to be installed in the plant of the McKeesport Tin Plate Company at Portvue, Pa.

THE HERSCHEDE-LIEBENSTEIN COMPANY, Cincinnati, Ohio, has moved to larger quarters at Room 1101, Provident Bank Building. The company carries an electrical construction, supplies and machinery business.

THE STANDARD ELECTRIC ACCUMULATOR COMPANY, of New Jersey, has been made the subject of a petition in bankruptcy. The company manufactures storage batteries at 91 Mercer street, New York city. It was alleged that the company is insolvent, and admitted in writing its inability to pay its debts. The company was incorporated in May, 1906, with a capital stock of $1,500,000. The liabilities are announced as $11,843.

THE CHARLES L. KIEWERT COMPANY, NEW YORK AND MILWAUKEE, is distributing a booklet devoted to the "Trucolor" pure carbon arc lamp. This lamp is the most recent product of the Kiewert Company and radiates a white, color true, steady light, which makes it particularly adaptable for interior illumination of stores and show-window lighting. The mechanism of the "Trucolor" lamp is practically the same as that of the "Aurola," another lamp manufactured by this company.

THE AMERICAN DISTRICT STEAM COMPANY, Lockport, N. Y., has published Bulletin No. 116, which is a reprint of the excellent paper by its manager, Chas. R. Bishop, on "The Advantages of Central-Station Heating to Electric Companies." This paper was read before the New England Section of the National Electric Light Association at its Portsmouth, N. H., meeting on September 10, 1909. It was abstracted at considerable length in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 6, and its merits are therefore well known to our readers.

THE CROWN WOVEN WIRE BRUSH COMPANY, Salem, Mass., reports that although there have been many changes in the use of dynamo brushes during recent years there continues a marked advancement for the Crown woven wire brush for low-voltage generators and rotary converters. These brushes are also being used on generators needed in the manufacture of many electro-chemical products. In the automobile industry a large demand for Crown brushes had been created for igniter and magneto work. Large quantities of these brushes in various sizes are being shipped to Canada, England, Germany, and many other foreign countries.

THE AMERICAN CONDUIT AND MANUFACTURING COMPANY, of Pittsburg, Pa., has issued a folder descriptive of its "Galvanite" rigid conduit. In this circular the well-known merits of this type of conduit are clearly stated, among the advantages that it possesses being the fact that its interior surface is thoroughly insulated and the exterior surface is coated with electrically deposited zinc, thus forming a perfect conductor, so as to insure the automatic grounding of the system, without need of special grounding clamps. The company is anxious to furnish detailed descriptive matter and other information in relation to this conduit upon request.

THE COLLIN ARMSTRONG ADVERTISING COMPANY, 25 Broad street, New York city, has recently been formed by men of long experience and acknowledged ability in advertising business. The president, Collin Armstrong, was for nearly twenty-five years financial editor of the *New York Sun*, in which position he not only established the reputation of the financial pages of that paper, but also of its advertising service. Mr. Armstrong is generally conceded to be a leader in the line of financial publicity. For the past eight years he was treasurer and manager of the advertising agency of Albert Frank & Company. His associates in the new company are Harry L. Cohen and Chas. Hartner, who also were connected with Albert Frank & Company for some twenty years.

DATES AHEAD.

International Independent Telephone Association. Annual convention, Chicago, December 7, 8 and 9.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) November 9, 1909.

939,212. SHOE-LAST. Adam J. Buch, Portsmouth, Ohio. Filed January 17, 1908. The toe piece is provided with an electrical heater.

939,223 and 939,224. PROCESS FOR ELECTRICALLY REMOVING IRON-OXID SCALE. Charles W. Danforth and Noble Jones, Sharon, Pa. Filed June 25 and August 28, 1909, respectively. The scale on the surface of the metal is subjected as cathode to the action of an electric current, while submerged in a solution containing bisulphate of an alkaline metal.

939,245. CREDIT SYSTEM. Jacob O. Greenwald, Milwaukee, Wis. Filed September 21, 1905. Describes a form of telephone system.

939,258. ELECTRIC SWITCH. Frederick Hoerle, Plainville, Conn. Filed November 12, 1907. Secondary contacts are mounted on

the base having a slot (extending from its edge), in which is fitted a post pivotally united to the switch arm. Connections are provided between the post and the primary contact.

939,292. TEST FOR FIRE-ALARM APPARATUS. James G. Nolen, Chicago, Ill., assignor of one-half to Frank B. Cook, Chicago, Ill. Filed September 24, 1903. A normally open switch is adapted automatically to close a short circuit around the testing device upon the operation of the signal-transmitting devices.

939,293. FIRE-PROTECTION SIGNAL-SYSTEM. James G. Nolen and John E. Shepherd, Chicago, Ill. Filed April 25, 1904. A water-tank float operates a signal-transmitting instrument in conjunction with a sprinkler system.

939,331. ALTERNATING-CURRENT ELECTRIC MOTOR. John T. Schaaff, Washington, D. C. Filed March 9, 1906. A phase-retarder is included in the circuit of one of a number of separate electromagnets.

939,337. SYNCHRONIZING DEVICE FOR PICTURE-MACHINES AND PHONOGRAPHS. Paul Seiler, Oakland, Cal., assignor of one-half to Samuel Joseph Johns, San Francisco, Cal. Filed October 7, 1908. Includes separate motor and ticker circuits, a phonograph, a picture machine, and a rhythmical make-and-break device in the ticker circuit, with means on the picture machine for simultaneously closing both circuits.

939,338. ELECTRICAL TRANSMISSION OF GRAPHIC MESSAGES. Gilbert Sellers, Chicago, Ill. Filed July 18, 1908. An apparatus for electrically transmitting messages, pictures and images of objects, comprises means for translating the image into a series of electrical impulses of varying intensity, a transmission-circuit, and means for retranslating these electrical impulses into a duplicate of the sending image including a series of revolving reflecting surfaces.

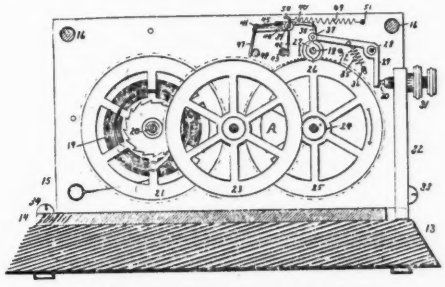
939,339. ELECTRIC TRANSMISSION OF MESSAGES. Gilbert Sellers, Chicago, Ill. Filed November 25, 1908. Similar to the preceding.

939,441. APPARATUS FOR PRODUCING ELECTRIC DISCHARGES. Harry Pauling, Gelsenkirchen, Germany, assignor to The Firm of Salpeters-Aure-Industrie-Gesellschaft, Ges. M. B. H., Gelsenkirchen, Germany. Filed December 18, 1905. The distance between a pair of electrodes is varied by movement of a conductor. The discharge may be extinguished by a blast device.

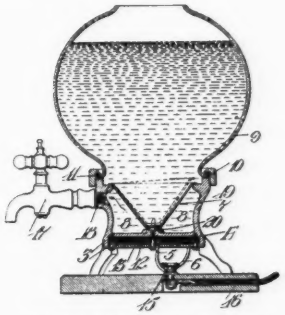
939,442. PROCESS FOR THE PRODUCTION OF VOLTAIC HIGH-CURRENT ARCS. Harry Pauling, Gelsenkirchen, Germany, assignor to The Firm of Salpetersäure-Industrie-Gesellschaft, G. M. B. H., Gelsenkirchen, Germany. Filed August 13, 1906. The process consists in elongating the voltaic arcs produced at the place of greatest proximity of the electrodes by causing them by suitable means to propagate along the electrodes and in passing the gas to be acted upon by the electrical discharges in currents of equal quantity and velocity in inclined direction against each other and meeting in the plane of the electrodes.

939,501. COUPLING FOR ELECTRIC CONDUCTORS. Jesse L. Hinds, Syracuse, N. Y., assignor to Crouse-Hinds Company, Syracuse, N. Y. Filed April 1, 1909. Describes a kind of slotted compressible sleeve with means for compressing the same.

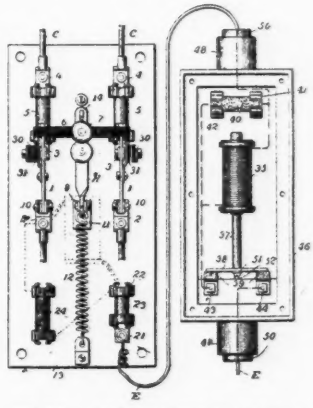
939,507. TELEGRAPH SENDING-MACHINE. John A. Hulit, Topeka, Kans., assignor, by mesne assignments, to The Hulit Transmitter Company, Topeka, Kans. Filed September 3, 1908. Comprises a frame, a rotary circuit closer mounted therein, a motor for driving said circuit closer, and manually controlled stops for stopping said motor with the circuit closed and for stopping said motor with the circuit open.



939,507.—TELEGRAPH SENDING-MACHINE.



939,605.—ELECTRIC WATER-HEATER.



939,730.—AUTOMATIC ELECTRIC CIRCUIT-BREAKER.

939,357. MAGNETO-ELECTRIC MACHINE FOR IGNITION PURPOSES. Charles A. Vandervell and Frederick I. Hoffman, London, England. Filed September 25, 1908. Comprises a current distributor, including a box of insulating material and having a series of paths joined up as one continuous path, contact pieces arranged in these paths, an armature, shuttle carried by the armature, the shuttle constituting a contact piece connected to armature, and means for permitting the shuttle to travel in the continuous path and make contact with the contact pieces arranged therein.

939,370. BLOCK-SIGNALING APPARATUS. Stephen A. Wood, Providence, R. I., assignor to United Electric Signal Company, Providence, R. I. Filed May 14, 1906. Comprises a target-arm, a second arm for operating the first arm and arranged and adapted to engage and disengage with it, and means for rocking the second arm.

939,383. TELEGRAPH-TRANSMITTER. Benjamin F. Bellows, Cleveland, Ohio. Filed July 29, 1907. A vibrator is deflected by a spring-actuated device under the control of the key lever.

939,401. TELEGRAPH SYSTEM AND APPARATUS. Thomas B. Dixon, New York, N. Y. Filed November 25, 1904. Renewed March 5, 1909. Describes a system of multiplex telegraphy.

939,409. ELECTROMAGNETIC RELAY. David I. Garretson, New York, N. Y., and Marcus O. Anthony, Englewood, N. J., assignors to Garretson-Anthony Company. Filed October 27, 1908. There are two contacts, one stationary and the other elastically mounted and connected with an armature. The electromagnet is so located that the armature may approach the magnet pole-pieces but is prevented from meeting them by the meeting of the contact pieces.

939,439. TELEPHONE ATTACHMENT. Henry R. Palmer, Seattle, Wash. Filed March 3, 1908. Describes a form of tubular receiver-supporting standard having telescopic sections.

939,523. MAGNETIC ORE-SEPARATOR. Wayne D. Ludwick, Seattle, Wash., assignor to Northwest Metallurgical Company, Seattle, Wash. Filed September 22, 1906. Renewed May 20, 1909. Magnets are spaced around the lower interior portion of a drum mounted to rotate in the receptacle of the separator, and further magnetic means are provided to remove magnetic material from the exterior of the drum.

939,599. TWO-POLE SNAP-SWITCH. Louis Kellner, New York, N. Y. Filed December 5, 1908. Comprises a sleeve having an arcuate rib with a central lug, a standard having a hole to receive this lug, a rocker plate having an arcuate slot to receive the rib, and a spring tensioned by the rocker to impel the sleeve and move the same angularly when it is released from the standard.

939,605. ELECTRIC WATER-HEATER. Henri O. Levy and George N. Blanchard, San Francisco, Cal., said Blanchard assignor to said Levy. Filed March 29, 1909. The heating unit comprises two sheets of insulating material and an interposed flat coil composed of a winding of bare wire and intermediate asbestos twine; a shellac coating on the inner surfaces of the sheets unites the sheets and winding to each other when heat is applied thereto.

939,625. APPARATUS FOR STRENGTHENING WEAK ELECTRICAL CURRENTS. Anton Pollák, Paris, France. Filed August 7, 1908. A microphone is used in combination with an electromagnetic device.

939,626. ELECTRICALLY-ACTUATED TRAIN-SWITCH. Joseph Y. Porter, Detroit, Mich. Filed December 10, 1908. Describes a form of trolley bridge.

939,630. MINER'S ELECTRIC LAMP. Hermann Remané, Berlin, Germany, assignor to Deutsche Gasglühlicht Actien Gesellschaft (Auergesellschaft), Berlin, Germany. Filed May 22, 1908. The lamp is carried by the removable cover of the battery box, rotation of a ring on the cover securing the latter to the box.

939,650. ELECTRICAL CONTROLLING SYSTEM FOR ROLLING OR SLIDING SHUTTERS, ELEVATORS, ETC. Lester G. Wilson, Larchmont, N. Y. Filed May 23, 1908. Describes the switches and connections for the operating electric motor.

939,658. TROLLEY-HEAD. Joseph J. Bennett, Pittsfield, Mass. Filed December 3, 1907. Has a rack device for limiting the rotary movement of the harp.

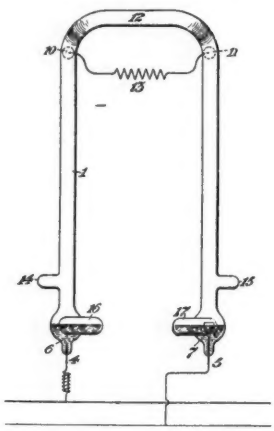
939,659. RAILWAY TRAFFIC-CONTROLLING SYSTEM. Henry Bezer, Newark, N. J. Filed January 18, 1907. Describes an electric traffic-controlling system for railways.

939,683. TELEGRAPH-TRANSMITTER. George M. Goddard, Rutland, Vt., assignor of one-third to George C. Thrall, Rutland, Vt., and one-third to Rutland Machine & Automobile Company, Rutland, Vt. Filed May 29, 1908. The key lever co-operates with cam and clutch mechanism for the shaft.

939,689. COUPLING FOR ELECTRIC CONDUCTORS. Jesse L. Hinds, Syracuse, N. Y., assignor to Crouse-Hinds Company, Syracuse, N. Y. Filed April 1, 1909. Similar to No. 939,501.

939,708. MERCURY AND OTHER VAPOR ELECTRIC LAMP. Henry A. Kent, Bound's Green, and Harold G. Lacell, Finchley, England, assignors to Silica Syndicate Limited, London, England. Filed December 1, 1908. Means in close proximity to the electrode are provided for raising the temperature of the latter to substantially that of its companion of different polarity, to prevent condensation of the vapor.

939,719. REMOTE ELECTRIC-CONTROL SYSTEM FOR SEARCH-LIGHTS AND THE LIKE. Alexis Le Blanc, New York, N. Y. Filed February 5, 1909. Comprises a motor, an electro-magnetically actuated switch for operating the motor, a local circuit for the actuating coil of the switch and motor, relays for controlling the local circuit, a controller and an independent source of current for operating one of the relays, whereby the switch is actuated to vary the speed and direction of the motor.



939,912.—GAS OR VAPOR ELECTRIC LAMP.

939,723. ELECTRIC-MOTOR FAN. Nathen A. Locke, Fulton, N. Y., assignor to Hunter Fan & Motor Company, Fulton, N. Y. Filed January 27, 1908. Comprises a frame, a vane-wheel (one of which parts is movable toward and from the other), a motor, power-transmitting means supported by the frame and interposed between the motor and vane-wheel, a switch for controlling the operation of the motor, and means operated by the switch for moving one of said parts toward and from the other.

939,730. AUTOMATIC ELECTRIC-CIRCUIT BREAKER. William F. Meter and William L. Rideout, Oshkosh, Wis., assignors to Electrical Manufacturing Company, Oshkosh, Wis. Filed July 22, 1908. In combination with a switch is an electromagnet in circuit with the switch to open the switch, also means constructed to open the circuit before the switch contacts are broken.

939,750. ALARM FOR CARDING-MACHINES. Eugene P. Schmitt, Seymour, Ind. Filed April 16, 1908. Comprises a vertically movable roving roller, a contact carried thereby, an electric circuit, and a single pair of terminals arranged on either side of the contact and adapted to be bridged by the moving contact in the extreme movement of the roller in either direction.

939,756. TELEPHONE SYSTEM. Frank E. Summers, Scotland County, Mo. Filed March 10, 1908. An emergency signal device is provided at each telephone instrument.

939,791. SELF-WINDING MECHANISM. Aaron D. Blodgett, Newton, and Fred S. Atkinson, Brookline, Mass., assignors to Blodgett Clock Company, Boston, Mass. Filed March 1, 1909. Is electromagnetically operated.

939,863. ELECTRIC SWITCH. Joseph H. Rusby, Nutley, N. J. Filed February 23, 1907. Describes a double-acting push-button switch.

939,872. PNEUMATIC-DESPATCH SYSTEM. Percy R. Shill, Leytonstone, England, assignor of one-fourth to Charles William Bluemel, one-fourth to Frank Henry Bluemel, and one-fourth to Ernest Adolphus Bluemel, Wolston, England. Filed August 14, 1908. Is electrically controlled.

939,904. CENTRIFUGAL MACHINE. George N. Goddard, Newton, Mass., assignor to American Tool & Machine Company, Boston, Mass. Filed November 11, 1905. Is driven by an electric motor the armature of which is mounted directly on the vertical shaft.

939,910. MAGNETO-GENERATOR. Robert H. Hassler, Indianapolis, Ind. Filed March 23, 1908. Comprises a cylindrical support providing a lubricating reservoir, a series of magnets arranged about the axis of the support and projecting at one end to form a multipolar magnetic field, a shaft in the reservoir and carrying an armature in the field, and means whereby the shaft may be revolved.

939,912. GAS OR VAPOR ELECTRIC LAMP. Peter C. Hewitt, New York, N. Y., assignor to Cooper Hewitt Electric Company, New York, N. Y. Original application filed April 9, 1904. Divided and this application filed June 29, 1905. The method of securing a closed metallic circuit between electrodes of a vapor electric apparatus, for the purpose of starting, consists in connecting the electrodes by passing the starting current between the electrodes within the container for a portion of the way adjacent to the electrodes, and for the remainder of the way more remote from the electrodes passing the current outside of the container.

939,924. ELECTRIC WARP STOP-MOTION. John Regan, New Bedford, Mass., assignor to Crompton & Knowles Loom Works. Filed March 18, 1909. The warp stop-motion for looms comprises a filling fork having a magnetic member thereon, an electric circuit, an electromagnet supported on a stationary part of the loom, a drop device to close the circuit and energize the electromagnet to hold the filling fork from being moved, a weft hammer to engage the filling fork and move it to operate mechanism to stop the loom.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 15, 1909:

486,068. ELECTRIC LOCOMOTIVE. Wm. E. Allington, East Saginaw, Mich.

486,078. ARMATURE FOR DYNAMO-ELECTRIC MACHINES AND ELECTRIC MOTORS. Charles S. Bradley, New York, N. Y.

486,094. SECONDARY BATTERY. Rudolf Eickemeyer, Yonkers, N. Y.

486,123. ELECTRIC METER. John Perry, London, England.

486,149. TEST-CIRCUIT FOR BURGLAR-ALARM SYSTEMS. Edmund R. Wilder, Kansas City, Mo.

486,176. ELECTRIC FORGE. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

486,212. CIRCUIT CONTROLLER. Harry W. Leland, Jersey City, N. J.

486,213 and 486,214. GOVERNING ELECTRIC MOTORS.—Robert Lundell, New York, N. Y.

486,234. ARMATURE FOR DYNAMO-ELECTRIC MACHINES. Albert L. Parcelle, Boston, Mass.

486,241. ELECTRIC SWITCH. Ernest P. Warner, Chicago, Ill.

486,243. ELECTRICAL ANNUNCIATOR. Franklin S. Carter, Burlington, N. J., and George P. Stumpf, Philadelphia, Pa.

486,264. ELECTRIC BATTERY. John J. O'Lalor, Boston, Mass.

486,282. MESSENGER-CALL SYSTEM FOR BUILDINGS. Frank H. Fuller, Springfield, and Charles B. Perkins, Holyoke, Mass.

486,315. ELECTRIC RAILWAY CONDUIT. Augustine W. Wright, Chicago, Ill.

486,324. SIGN FOR ELECTRIC LAMPS. Edwin W. Clay, Louisville, Ky.

486,333. TROLLEY FOR ELECTRIC RAILWAYS. Augustus H. R. Guiley, South Easton, Pa.

486,334. REGULABLE ELECTRIC LAMP. George W. Hall and Joseph J. De Marr, Georgetown, Colo.

486,338. ELECTRIC ALARM. Henry A. Hull, New Brunswick, N. J.

486,354. ELECTROMAGNETIC BELL. James J. Ross, Detroit, Mich.

486,377. ELECTRIC ARC LAMP. Daniel Higham, Boston, Mass.

486,417. REGULATOR FOR DYNAMO-ELECTRIC MACHINES. Alexander Dow, Elgin, Ill.